UNITED STATES MINT

AT PHILADELPHIA

JAS. RANKIN YOUNG

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BY

JAMES RANKIN YOUNG

ILLUSTRATED

FOR SALE BY
CAPT. A. J. ANDREWS
ODD FELLOWS' TEMPLE
PHILADELPHIA

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PHILADELPHIA
1903

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NEW UNITED STATES MINT AT PHILADELPHIA

Introductory

Mr. George E. Roberts, the Director of the Mint of the United States, in his last annual report to the Honorable Leslie M. Shaw, the Secretary of the Treasury, has this to say of the new Mint at Philadelphia: "This beautiful new edifice is unquestionably the finest building ever constructed for coining purposes in the world."

The Federal Government is expending vast sums of money in the erection of public buildings all over the country. It was a policy that had its inception during the administration of President Grant. It was a part of what he termed a plan for internal improvements that would lift the country from a rut into which it had fallen prior to and during the Civil War. The erection of public buildings was considered by him as next in importance to the improvement of the rivers and harbors.

The city of Washington was made the starting point. What has been done there in the way of evolution in the matter of improvements is among the foremost in the conspicuous events of this country's history in the last quarter of a century. And, judging from what has been planned for the near future, it is not much more than a mere beginning. It was a knowledge of the utility and the beauty of these improvements that led the national Legislature to favor an expansion of the system of public buildings that would cover the entire country.

The idea was accepted as being not only useful and economic in its scope, but as especially patriotic. After the school house comes the United States building. The post office follows the school house. Wherever you see a public building you will see flying the American flag. It is representative of the solidity and the solidarity of the Republic. The public building, it may be said, comes as near to the hearts of the people as does the flag. In response Congress deals with a lavish hand in making appropriations for the erection of public buildings. The citizen who has never seen the Capitol at Washington has yet to feel the most exhilarating pulse of a patriotic heart.

It is not in my power in this brief publication to do justice to the beauty of the architecture of the Mint, and to the completeness of the details of its internal arrangements. It must be seen to be appreciated, and no one having the opportunity to make a visit should fail to do so. This admonition, I may say, is hardly necessary, for I am informed by my valued friend, Captain A. J. Andrews, under whose immediate supervision are placed by the Superintendent the corps of conductors whose special duty it is to look after the comfort of visitors by showing them the building and what it contains, that no Federal building in the country outside of the principal ones at Washington has more visitors than the Mint at Philadelphia.

While the building is perfect in every detail, that which is accomplished within its walls is a study in itself—a study that should interest everybody. We all handle and know the value of the coins that bear the stamp of Uncle Sam, but how many of us are there who know by what processes these pieces of metal are made into money? I venture to assert that the number is small.

Each subject treated of in the following account is compiled and edited from data furnished by the particular official of the Mint who is the authority thereon. Beginning with a sketch of the Mint service at Philadelphia since its inception the reader is made acquainted with the personnel of those who control and direct that service as it exists at the present time. Next follows a description of the new edifice and its furnishings. Passing through the massive bronze doors at the main entrance the visitor finds himself in the spacious lobby with its mosaic panelled ceilings and walls. Through the broad vaulted corridors he is shown on the main floor the offices of the Superintendent and his executive staff. Then he is given a sight of the numismatic room, where are gathered for public inspection a collection of the representative coins of the world, dating back to a period before the Christian era—a collection most valuable and precious. From the corridors surrounding this department the visitor sees before him the workrooms, with the work of minting going on. Mounting the main stairway to the second floor a view is obtained of the white corridor formed by a series of beautiful marble columns.

After taking a look at the finely-appointed room of the Assay Commission the visitor is shown in regular order the processes through which a piece of metal must go before it becomes a coin of the Republic. First is the room where the bullion is received, weighed and deposited; next the room of the refiner, where the pure metal is separated from the base; then the room where the metal is melted, alloyed and cast into ingot bars; next back to the hands of the assayer; then to the room where the metal that is found to be up to the required standard of fineness goes through the workmanship that rolls it into long ribbons, from which the blanks or planchets are stamped; next to the room where the blanks are weighed and adjusted and where those that are found to have the legal weight are raised around the edge and cleaned; then to the room where on the finished blanks the coin is stamped, and finally into the rooms where respectively the coins are weighed, counted and packed into bags, to be transferred to the office of the cashier for shipment.

In closing, I wish to acknowledge to Mr. Landis, the Superintendent of the Mint, and to his immediate staff of assistants, my indebtedness to them for the information they have imparted and for the many other courtesies they have extended to me.

James Rankin Young.

The United States Mint at Philadelphia

I.

HISTORICAL SKETCH.

One of the first problems to confront the founders of this nation after its independence had been established was the creation of a national uniform currency. During the early Colonial days bullets, cotton, cloth, corn, furs,

FIRST MINT BUILDING AS IT IS TO-DAY

tobacco and codfish were used as mediums of exchange in different parts of the country. Later, coins were struck by individual groups of colonists or private individuals. As early as 1652 a Mint was established in Boston, from which silver coins of several values were issued. Little of the English coinage remained on this side of the Atlantic, as the balance of trade was almost wholly in England's favor. In the years of unrest preceding the Revolution the need of a Royal Mint in the colonies was so strongly felt that its absence

was urged as one of the grievances against the mother country. During the Confederation each colony was an independent, sovereign State in all matters except those expressly delegated to Congress. Each State had the acknowledged right to coin its own money, though the right of regulating the alloy and value thereof was vested in Congress.

On the 15th of January, 1782, the great Colonial financier, Robert Morris, as head of the Finance Department, laid before Congress a detailed report on the coins in circulation in the United States and a system for the creation of a national coinage. This report was constructed and compiled in answer to a request made at the previous session of Congress. No action seems to have been taken on the same, though Morris continued to agitate the subject and use his influence to have a Mint established as early as possible. Allied with him in these efforts were Alexander Hamilton and Thomas Jefferson. On April 15, 1790, Hamilton, then Secretary of the Treasury, was instructed to submit a plan for a national coinage system, which he presented in a report to the next session of Congress.

It was not until April 2, 1792, however, that an act was passed establishing the United States Mint. In this act George Washington, as the President, was authorized to take such steps as were necessary to establish a Mint. Washington took a deep personal interest in the enterprise, and it is said that some of the original "dismes" and "half-dismes" were struck from his private plate.

As a result of this act of 1792 a plot of ground was purchased in Philadelphia, located on the east side of Seventh street, below Arch street. An old still-house that stood on the site was removed and in its place was constructed the third building for government use erected by the United States Government. The first government building was erected at the Lazaretto, on Tinicum Island, in the Delaware river, near the lower part of Philadelphia. This was used for quarantine purposes; and the second, built at Chelsea, Massachusetts, as a marine hospital. The original Mint building still stands, Nos. 37 and 39 North Seventh street, an unnoticed though remarkable historic edifice. Within almost a stone's throw stood, until a few years ago, the building in which Jefferson wrote the Declaration of Independence, southwest corner of Seventh and Market streets.

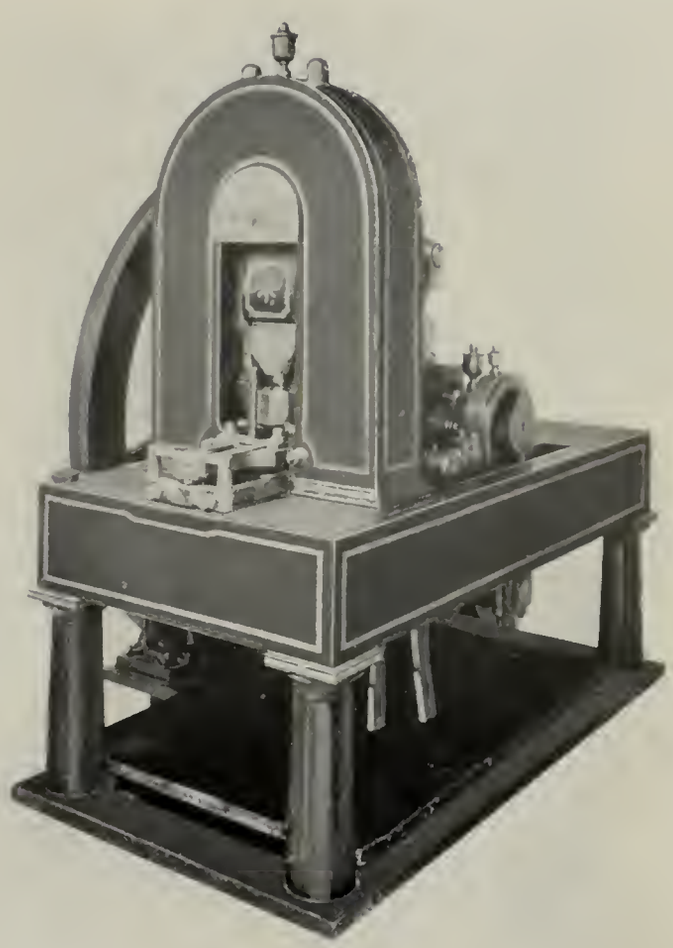
Some silver coins, half-dimes, were struck in October, 1792, attention to which was called by the President in his annual message of that year to Congress. The first coinage authorized by Congress, however, was an issue of copper cents in 1793. For this purpose the first invoice of copper consisted of six pounds, where to-day tons of that metal are received every month. The copper used in the early minting operations was imported from Europe, as was all the minting machinery used at that period. At the present time the United States produces one-fourth of the world's product of copper. The first authorized silver coins were minted in 1794, and the first gold pieces in 1795.

SECOND MINT BUILDING AT TIME OF LINCOLN'S DEATH

(From old photo in possession of G. B. Soley)

The man wearing a high hat and leaning against the pillar is Gov. Pollock, then Director of the Mint. On his right is Prof. Booth, the Melter and Refiner.

The ratio of the silver dollar to the gold dollar was fixed at fifteen ounces of the former to one of the latter. The coinage was to be free and unrestricted and the dollar to be a legal tender for all debts. In 1834 Congress passed an act reducing the weight of the gold dollar so as to make the ratio between the silver dollar and it stand at 16.002 to 1. In 1837 Congress again changed the ratio, fixing it at 15.988 to 1, or 16 to 1, as it is commonly called at the present time. No change in the ratio has since been made.



FIRST STEAM COINING PRESS

The coinage of silver dollars was discontinued in 1873. None had been in circulation for many years, and at that time the silver dollar had a greater value than the gold dollar. Up to that period the total coinage of silver dollars had been $8,045,838. The coinage of silver dollars was resumed in 1878, the law stating that they should be a legal tender for all debts unless it had been expressly stipulated that the said obligations should be paid in gold. This law further provided that not less than two million or more than four million dollars' worth of bullion should be purchased monthly. Congress amended this law in 1890 (the Sherman bill) by making it compulsory that four million dollars in silver should be purchased monthly. In 1893 this law was repealed, and since that time no silver has been purchased by the government. Up to that date the total coinage of standard silver dollars had been over $431,000,000.

Up to 1816 all mint operations were done by hand or horse power. In that year steam was introduced. In the Assayer's Department to-day the Assayer, Mr. Jacob R. Eckfeldt, whose ancestors have been connected with the Mint since 1795, shows a small screw press little larger than a letter press, which it resembles. This was the original coining press. It is now used to press the little ash cupels used in assaying. In 1836, when Robert M. Patterson was Director of the Mint, the first coining press run by steam was installed. It was a machine, weighing about three tons and having a coinage capacity of one hundred pieces per minute, which had been invented

ENTRANCE TO NEW BUILDING

by M. Thonnelier in France three years before, and was built by Merrick, Agnew and Tyler, of Philadelphia. In 1858 it was remodelled by David Gilbert, J. Ross Snowden being then Director. This press has also become a relic, and is now owned by Mr. G. B. Soley, of the Engraver's Department. The twenty-five coining presses now used are supposed to be the best designed machines in the Mint, and represent the gradual development of a press installed in 1874. Since 1899 experiments have been regularly conducted aiming at improvements in the various minting processes. The results of this spirit of enterprise are visible to-day in every department.

For forty years the Federal Government continued to use the old building on Seventh street as the national Mint. These forty years had seen giant strides made in our commercial development, and the necessity arose for a larger Mint to meet the demand for more money. On the 4th of July, 1829, the corner-stone was laid for a new Mint on the northwest corner of Chestnut and Juniper streets at a cost of $281,000. Of this amount $31,666 was paid for the site. About a year ago the property was sold by the government for $2,000,000. For over seventy years this simple edifice, with its half dozen plain Ionic columns, was a landmark in Philadelphia. Again, however, despite the fact that this "mother Mint" had now a progeny in various parts of the country, the nation's growth demanded that the minting facilities at Philadelphia be enlarged. The subject was agitated for many years before any action of a definite character was taken.

At the beginning of the third year of the administration of Benjamin Harrison (1891) the Secretary of the Treasury, William Windom, in a report to Congress called attention to the fact that the business done at the Mint at Philadelphia had grown beyond the capacity of that establishment, and he recommended that immediate provision be made for the erection of a building that should meet not only the current requirements, but those for many years to come.

In order to comply with this recommendation Senator James Donald Cameron, of Pennsylvania, introduced a bill in the Senate (February 19, 1891,) to provide for the purchase of a site and the erection of a building for mint purposes thereon, at Philadelphia, in the State of Pennsylvania. This bill was passed by the Senate, without debate, and by a unanimous vote, February 26, 1891. When the bill was reported to the House of Representatives, Henry H. Bingham, the member from the First district of Pennsylvania (Philadelphia), asked that it be accepted as a substitute for a bill of similar import pending in that body. The motion was agreed to by the House March 3, 1891, but not until after a determined opposition had become exhausted. This opposition came from two sources—the persons who believed that such a building as was proposed would cost too much, say, from two millions to five millions of dollars, and the persons who believed that the new building should be placed either in New York city or in some city in closer proximity to the gold and silver producing sections of the country. This last

proposition meant St. Louis. The argument put forth was that the metropolis of the Central Mississippi region was the proper location for the principal Mint of the country. The idea had back of it powerful supporters. The history of the country since the era immediately succeeding the Civil War shows that the St. Louis people, with a commendable and patriotic spirit, have ever been anxious to secure from the central government at Washington some special recognition that would make their city stand out conspicuously in comparison with her sister cities. A quarter of a century or more ago a most determined effort was made to have the seat of government changed from Washington to St. Louis. It was a formidable movement, and at one time it looked as if it might prove successful. The capital city was in a miserable condition at that period, and it was this attempt to take from it its official character that spurred its people and Congress to begin the improvements that have made it the beautiful place it is to-day. Nothing daunted by this failure and the later failure to secure the new Mint, the St. Louis people kept up their struggle for recognition. Success came in the last Congress—the 47th—when an act was passed authorizing the holding of a world's fair or international exposition at St. Louis in 1904, in commemoration of the centennial of the Louisiana Purchase, and appropriating five million dollars in aid of the project. This promises to be the finest and the most complete exhibition of the progress that has been made in the last century that the world has ever seen.

Former United States Senator Thomas H. Carter, who at the time the Mint bill was under discussion in the House was a member of that body from the State of Montana, really broke the backbone of the opposition to the passage of the bill by a speech, in the course of which he said: "On the occasion of a recent visit to Philadelphia in connection with the annual Assay Commission I was permitted to examine the various appliances and the rooms in which they were used at the Mint, and I want to add my testimony to the fact that there does not exist on this continent to-day an intelligent and prudent business man who would ask free-born American citizens to spend their lives and perform their duties in the cold, damp, subterranean passages in which our fellow-citizens are compelled to work in the Mint at Philadelphia."

The first site considered for the new Mint was the block on Sixth street, running from Sansom to Walnut streets, having Independence Square for an east front and Washington Square for its front on the south. The late George W. Childs and the Drexel interests worked hard to have the government accept the location, and the Secretary of the Treasury was anxious to do so, but the persons who owned the property held the same at too high a figure. Next the site at the northeast corner of Broad and Cherry streets, opposite the Odd Fellows' Temple, was considered, but a like obstacle presented itself. Finally the present location was agreed upon—the block bounded by Sixteenth and Seventeenth and Spring Garden and Buttonwood streets, having the main front on Spring Garden street.

II.

The New Mint Building

The first and lasting impression given by the new Mint building is one of beauty and strength; the classic lines of the Roman Ionic architecture lending themselves very aptly to the huge blocks of granite to accomplish this effect. This impression is again pointedly brought to view by the massive bronze doors with the lions' heads moulded on them that are set in the three graceful arches at the head of the broad flight of stairs leading to the main entrance on Spring Garden street. From the viewpoint of utility as well as beauty the edifice ranks with the new Library of Congress as one of the most satisfactory buildings erected by the government in recent years. The ground area covered by the building contains 58,000 square feet.

BRONZE DOORWAY

The plan consists of a hollow square, with a front facing on each of the four streets. A cross wing in the centre makes two interior open courts. The main entrance is on Spring Garden street. On the Sixteenth street side there is a driveway opening into two interior courts, where entrances to the building proper are located. The courts are faced with white enamel brick, having granite trimmings, and insure ample light and air to all the rooms opening on them. The large, light workrooms form a distinct feature.

The front portion of the building is three stories high above the basement and terraces. The rear portion is one story lower than the front, but, owing to the slope of the ground, the basement is here almost entirely above ground, which gives three clear stories to this portion also.

The building is as nearly fire-proof as modern methods can obtain, the floors and partitions being of terra cotta blocks, while the roof is made of concrete, covered with vitrified tile.

THE LOBBY.

The main vestibule or lobby, reached by the Spring Garden street entrance, is finished with strongly veined Italian marble, with vaulted mosaic ceilings. The wall panels, formed by the vaulted ceilings above the marble sides, are pictorially treated with glass mosaics. These mosaics form one of the most beautiful and expressive features in the building. They are a unique example of the American development of the arts and crafts.

LAMP AND TABLET AT ENTRANCE

The ceilings are covered with a solid mosaic of gold, each unit being a piece of glass backed with gold. The effect is rich and dazzling.

The panels above the wainscot illustrate the ancient methods and processes of coinage. These mosaics are from designs by Mr. William B. Van Ingen. One of the novel elements of his conception is the employment of figures of children instead of men. The use of children in this sense may seem incongruous, yet it was suggested by the fresco found in the house of Vetelli, which was buried under the lava of Vesuvius in the year A. D. 79. The mosaics were executed by the famous Tiffany studios in New York, under the personal direction of Mr. Louis C. Tiffany.

The general methods of mosaic working can be described under two classes—direct and indirect. The first is where the surface of the wall is treated with the plastic material to receive the several pieces of glass and the pieces placed on it one by one. The second is where the pieces are separately cut and placed on paper and then slabbed by plaster being poured over the back of the complete panel when finished, and then set in position.

The method here used was on the general lines of the indirect process, as it is found that the best effects can be obtained in this way, and that during the progress of the work it can be corrected as desired. Glass mosaic is the most durable of all materials, as the nature of the glass renders it impervious to the disintegrating influences of the elements and a non-absorbent of atmospheric and chemical gases. From the artistic side it is without a rival where permanency in union with color is desired.

LOBBY

MOSAIC PANEL

Comparing these mosaics with the creations in the same material of all periods they undoubtedly take place among the finest examples of the art. The series of panels cost about $40,000.

To the right on entering the lobby is the visitors' waiting room. Directly opposite is the conductors' or guides' room. Visitors are admitted to the building from 9 o'clock in the morning until 2 o'clock in the afternoon on every week-day, excepting Saturday, when the hours are shortened from 9 o'clock to 11. Every few minutes one of the guides conducts a group of visitors through the building, explaining the various operations, finally leaving them to inspect the coins and curios in the cabinet at their leisure.

Many curious experiences are related by the guides. It is by no means infrequent for these men to receive inquiries regarding the days on which sample coins are given away. The courteous reply is generally, "The 30th of February." Many visitors also have the idea that they must be searched before leaving the building, and present themselves for this purpose to the attendant at the door. An instance is related of a woman of portly build who presented herself to the captain of the watch and said she was ready to be weighed. That embarrassed gentleman, in confusion as to whether she wanted to test the scales or simply see how much she weighed, finally found out that she understood every visitor must be weighed before leaving the building, in order to discover whether or not he or she had any precious metal secreted about his or her person.

Broad vaulted corridors extend east and west from the lobby, giving access to the first floor. On the west corridor are the superintendent's offices and the coiner's offices, the stairway at the end leading down into the coining room. On the east

MOSAIC PANEL

MOSAIC PANEL

corridor are the deposit rooms, cashier's offices and melter and refiner's offices, the stairway at this end giving access to the melting room.

Leading from the entrance vestibule, and directly opposite to the entrance doors, is the main staircase, which is elaborately finished in strongly veined Italian marble. At the first landing, half way to the second floor, is the main entrance to the numismatic room. This room is situated on a mezzanine floor, being half way between the first and second floors of the rear portion of the building, and is arranged for the exhibition of the large collection of coins and medals of all kinds now held at this Mint. It is directly accessible to the public and is surrounded by corridors, from which the visitors can look down into the workrooms, and there watch the operations of minting being carried on without disturbing the employees. The floors of the various public corridors and of the numismatic room are richly ornamented mosaic.

Continuing to the second floor on the main staircase we see the white corridor, a beautiful effect at the head of the stairways formed by a series of marble columns. Directly over the entrance corridor is the room in which the Assay Commission meets every year. In the east corridor are the rooms of the superintendent of machinery and in the west corridor the rooms of the engraver. Over these, on the third floor, are the sewing room, dining room and assayer's rooms.

In the rear portion of the building are the more strictly working departments of the Mint, as the melting rooms, machine shops, rolling mills, annealing furnaces, refining rooms, adjusting rooms and the coining presses.

In the basement are boiler rooms, engine rooms, gas and power plants, storeroom, etc., and also immense

MOSAIC PANEL

storage vaults, where at the present time are stored several hundred millions of silver dollars, besides a considerable quantity of gold bullion and subsidiary coin.

The entire building cost $2,025,000. Of this amount $329,338.71 was paid for the site and incidental expenses.

The general contractor for the superstructure and finishing of the building was Charles McCaul, of Philadelphia, his bid being about $1,500,000. The work was completed, however, owing to the death of Charles McCaul, by the Charles McCaul Company, which had succeeded to his business.

The supervising architects were William Martin Aiken, under whom the preliminary sketches were started, and James Knox Taylor, under whose direction the working drawings were prepared and the work carried on to completion. The Secretaries of the Treasury, under whose administration the work was carried out, were John G. Carlisle, of the Cleveland administration, and Lyman J. Gage, of President McKinley's Cabinet.

MOSAIC PANEL

III.

The Working Force

The officials now in office at the Mint (1902-3) are:

John H. Landis, Superintendent.
Jacob B. Eckfeldt, Assayer.
Homer L. Pound, Assistant Assayer.
David K. Tuttle, Melter and Refiner.
E. K. Leach, Assistant Melter and Refiner.
Rhine R. Freed, Coiner.
Robert Clark, Assistant Coiner.
Charles E. Barber, Engraver.
George T. Morgan, Assistant Engraver.
Joseph D. Murphy, Cashier.
Dr. Albert A. Norris, Chief Clerk.

JOHN H. LANDIS, the Superintendent of the Mint, was born in Manor Township, Lancaster County, Pennsylvania, January 31, 1853; was educated in the common schools, at Millersville Normal School and in the country lyceums; worked in the mill and on the farm during his early life; was proprietor of the Colfax Glen Mills, at Windom, Pa., until 1894; was elected to the Pennsylvania House of Representatives in 1878, re-elected in 1880 and again in 1882; was one of the editors of the "Plumed Knight," published at Lancaster, Pa., in 1884; was United States Census Supervisor in 1890; was elected State Senator in 1892; was appointed by President McKinley, January, 1898, Coiner of the United States Mint at Philadelphia, which position he filled until he was appointed Superintendent of the Mint by President Roosevelt, in 1902; was for many years President of the Agricultural and Horticultural Societies of Lancaster County; is President of the Lancaster Chemical Company and of the Old Guard Mutual Fire and Storm Insurance Company; is a trustee of the Millersville State Normal School; is a manager of the

JOHN H. LANDIS
Supt. of the Mint at Philadelphia

GRAND STAIRWAY

Thaddeus Stevens Memorial Association; has been director in various corporations; is an elder of the Reformed Church at Millersville, and is noted for the active interest he has taken in public affairs.

David K. Tuttle, the Melter and Refiner, was born in New Jersey. At fifteen he started to work for his brothers at Brooklyn, two years later being in charge of a small electrotyping plant; received the degree of B. S. in 1855 after a two years' course in the Lawrence Scientific School of Harvard; after two years more of study at the Georgia Augusta University, at Gottingen, in Germany, the degrees of M. A. and Ph.D. were conferred upon him; in 1857 he was appointed a Professor in Analytical Chemistry at the University of Virginia; after five years at this institution he commenced a thorough study of the mining and treatment of gold, silver, lead and iron ores; was appointed Melter and Refiner of the Carson City Mint in 1886; two years later he was transferred to Philadelphia to succeed James C. Booth as Melter and Refiner; is a member of the American Philosophical Society, the Franklin Institute, the American Chemical Society and other scientific organizations.

Jacob B. Eckfeldt, Assayer, was born in Philadelphia in 1846. He first entered the Mint in 1865 as Second Weigher in the Assay Department under his father, Jacob R. Eckfeldt, who was then Assayer. In 1872 he was appointed Assistant Assayer, and in 1888, Assayer.

Rhine R. Freed, Coiner, was born at North Wales, Montgomery County, Pennsylvania, November 17, 1863. He attended the public schools and a private academy at that place and later the State Normal School at Millersville and a business college in Philadelphia; at the age of twenty-one he entered the firm of E. K. Freed & Co., flour millers, and continued in the firm until 1901; in 1899 he was elected Register of Wills for Montgomery County; in 1902 he resigned that position and was appointed Coiner of the United States Mint at Philadelphia.

Charles E. Barber, Engraver, was born in London in 1840. He was appointed Assistant Engraver in 1869 and succeeded his father as Engraver in 1880. Mr. Barber engraved the medals of Presidents Garfield and Arthur, the Indian Peace and Army Marksmanship medals and the Great Seal.

Joseph D. Murphy, Cashier, was born in Philadelphia in 1850. He attended St. Joseph's College, in Philadelphia, and the University of Notre Dame, in South Bend, Ind., where he graduated in 1868; followed journalism as a profession, being connected with the "Age" until 1884, when he was appointed Chief Clerk in the office of the Surveyor of the Port and later a Special Deputy Surveyor; in 1888 he resigned and returned to journalism, identifying himself first with the Philadelphia Times and later with the Inquirer; in 1889 was appointed Cashier of the Mint. Mr. Murphy has been a member of City Councils and of the Board of Education.

MOSAIC PANELS

Albert A. Norris, Chief Clerk, was born in Philadelphia, May 11, 1854; graduated from the Protestant Episcopal Academy in 1871; attended special course in analytical chemistry at University of Pennsylvania; entered business college 1875; read law in the offices of John Shallcross two and a half years; engaged in cotton and wool manufacturing business in 1881; entered Hahnemann Medical College 1884, graduating in 1887; employed in new Congressional Library, Copyright Department, 1898; was Federal agent for Philadelphia controlling sale of Revenue Stamps; appointed private secretary to Superintendent of Philadelphia Mint December 19, 1898; appointed Chief Clerk of Philadelphia Mint March 21, 1899, and is Acting Superintendent in the absence of the Superintendent.

Too much cannot be said in praise of the force the government has employed in the coining of its money. The visitor receives the courteous word of deference from whomever he accosts, be it one of the force of conductors or the head of a department.

In every department of minting the judgment of the individual operator is of essential importance. This personal factor is especially noticeable in the assayer's delicate observations, the intricate calculations of the melter and

the engraver's minute handiwork; but it is just as vital if not so much in evidence in all the other operations of the Mint. As a result we find among the employees many who have spent a score of years in the Mint's service, attaining by their long experience a special skill that makes them invaluable. One observes also among these veterans of the service enthusiasm and pride in their work, and particularly that done by each in his special department, which accounts for the high efficiency of the Mint's work in as large a measure as the modern equipment of the institution.

To these qualities of exceptional skill, enthusiasm, earnestness and courtesy the employees as a class may also claim with pride the further distinction of being exceptionally honest. The temptations which a workman has in the Mint are unusually great. Precious metals, a mere handful of which would be worth hundreds of dollars, are handled in truck-loads, undergo chemical changes, are melted, chipped, filed and hammered. It is true that more than ordinary precautions are taken to prevent the loss of a single grain, yet bars and bolts and the closest system of checking can hardly account for the almost entire absence of losses since the founding of the institution.

MOSAIC PANELS

IV.

The Coining of the Money

SUMMARY OF COINAGE PROCESSES.

The process of coining money is briefly as follows: The bullion is received at the deposit or weighing room, where it is weighed and the depositor paid according to an assay which is made of a part of the deposit. This bullion is taken to the refiner, who separates the precious metals into masses of pure metal. These are transferred to the melting room, where they are melted, alloyed and cast into ingot bars. Again the metal is assayed, after which, if it is of the legal fineness, it is rolled into long ribbons in powerful rolling machines, from which the blanks or planchets are stamped by the cutting presses. The blanks are weighed and adjusted and those of the weight fixed by law are raised around the edge and cleaned. On these finished blanks the coin is stamped. They are then weighed, counted, packed into bags and transferred to the cashier ready to be issued.

EAGLE ON STAIRWAY

Of these departments, the visitor is shown from the gallery, the furnace room, where the melts are made and the ingot bars cast; the rolling presses and cutting machines, and the coining presses and counting boards. The other departments, which will be described in their proper place, being more purely scientific, do not possess the same interest to the general public that these do.

THE DEPOSIT OR WEIGHING ROOM.

All of the precious metals brought to the Mint go first to the deposit or weighing room. This is the first office on the south side of the corridor running east from the main entrance hall. The Mint recognizes no one as a depositor except the person who presents the bullion at the Mint, and, incidentally, no one connected with the Mint is allowed to make such deposits.

The deposit is weighed on delicate scales in the depositor's presence and a receipt with the deposit number on it given to him. The deposit is then placed in a strong box under double lock and kept entirely separate until

after it is melted, assayed and the exact value ascertained, based on the weight after melting. On the third day after making his deposit the depositor returns and is paid. Deposits of gold are paid in gold coin or bars; if the deposit also contains silver, the value of such silver will be paid to the depositor in silver coins, at the price fixed by the Director of the Mint.

Gold is received at the Mint in the form of bars, lumps, grains or dust, in their native state, free from earth and stone, or nearly so, and amalgam with the quicksilver expelled. Foreign coin, defaced United States coin, United States coin issued before 1834 and United States coin abraded beyond one-half per cent. for twenty years' circulation, are also received. No silver is

DEPOSIT ROOM

now bought by the government, except such as is mixed with the gold in the bullion deposits. Base bullion containing less than 300 parts of gold per thousand will be refused. Deposits of less value than $100 and bullion unsuitable for operations at the Mint may be refused. Filled or plated ware is not accepted. Where base metals are present, as in jewelry and dentists' plate, the deposit is subject to loss in refining. An ounce Troy of pure gold is worth $20.67. In native gold it would take from six to eight ounces to produce a value of $100.

Most of the gold received at the Mint comes as bullion pigs, looking like large metal bricks, from the different assay offices of the government. Practically all the nickel comes from the mines at the Gap, in Lancaster County, Pennsylvania, and the copper from the Lake Superior mines. The nickel and copper is received already refined, stamped and milled, ready to have the design stamped on it by the coining presses, making it coin.

The heavy work of the deposit office is done by a deputy in a small room on the southern side of the building, called the transfer weigh room. All the large consignments of gold bullion and the deposits of nickel and bronze are received and weighed in this room. The scales here are of the largest type in the building, the beam being about six feet long and swinging some five feet above the ground. The working parts are enclosed in glass to keep out particles of dust. The beam rests on the pointed edge of a wedge-shaped base of steel. So delicate is this balance that it will weigh anything from a mass of 10,000 Troy ounces (about 685 pounds) to one weighing the hundredth part of an ounce. The latter weight looks like the point of a pencil in the palm of your hand and feels about as heavy. The scales are carefully adjusted every day, and sometimes oftener. Like all the other scales in the institution, they were made by Henry Troemner, of Philadelphia.

All the nickel and bronze coins in the country are coined at this Mint. Large box-loads of blanks for pennies are received here daily. The blanks are scooped out and placed in big metal pans, when they are weighed and emptied into trucks, four or five feet high, in which they are transferred to the coiner. An average of twenty-two tons of bronze and nickel per month are weighed on these scales.

All the old coins that have been redeemed by the Sub-Treasuries are brought here and weighed. There is about $5,000,000 worth of these old coins redeemed in a year.

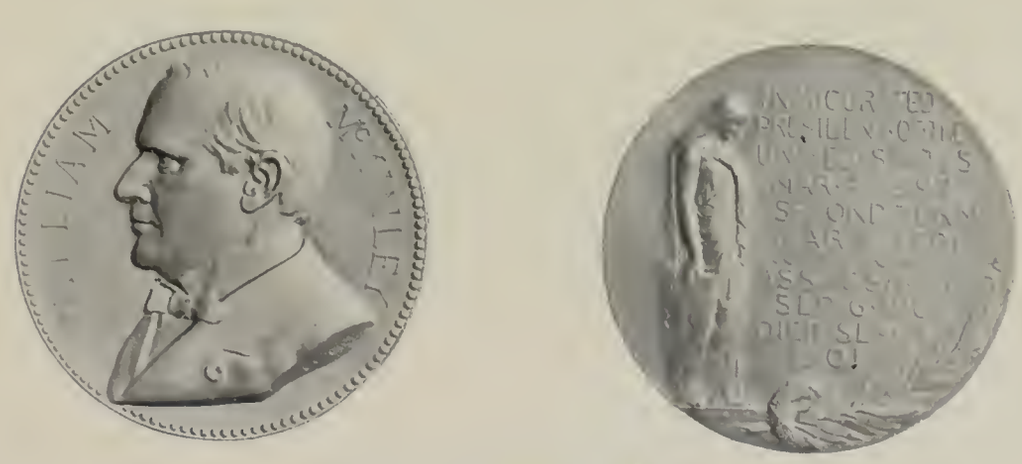
While no silver bullion is being bought by the United States, there is a considerable quantity being coined from the immense deposits collected under the Sherman Act. There is also some silver being coined for some of the small American Republics.

THE DEPOSIT MELTING ROOM.

After the metal is weighed by the deposit officer it is placed, with the deposit number, in a metal box under double lock and transferred to the next adjoining room in this corridor—the deposit melting room. This is a room about twenty feet square, in which the most salient features are three furnaces, a small grinding mill and some acid tanks. The iron box from the deposit room is here opened and its contents placed in a crucible with a flux of saltpetre or borax, and melted. Each deposit is worked separately, of

course, until the depositor has been paid for it. The melt is poured into an iron mold. When it has cooled the metal cast is taken out and the flux, looking like a layer of dark glass, is knocked off. Any foreign substances are then chipped off and the cast is dipped into a weak solution of sulphuric acid to remove impurities. The deposit number is then stamped on it and it is ready to be returned to the deposit room for re-weighing. Before this is done, however, the flux and chippings from the cast are placed under the heavy stones of the mill and crushed to a powder. The powder is then "washed" in a pan with a turned in edge, just as they "wash" gold in the Western rivers. Any stray pieces of precious metal left after the dust has been washed off are collected and put back with the deposit.

After the cast has been re-weighed a small piece of gold is chipped off the corner and sent to the assayer. From his examination of this piece the fineness of the whole lump is determined and on this basis the depositor is paid. The cast or pig is then taken to the vaults and stored, ready for the melter and refiner.



McKinley Memorial Medal
(Obverse and Reverse)

V.

The Melter and Refiner

The Melting and Refining Department, employing about seventy-five skilled men, refines the gold and silver bullion, melts it, adds the alloy, casts it into ingot bars and hands these over to the coiner ready for the process of rolling. The offices of the melter and refiner are on the main floor, in the northeast corner of the building. The furnace room, where the melts are made, is on the second floor of the rear portion of the building, running along

MELTER AND REFINER'S OFFICE

the eastern side. The refining or parting room is on the floor above this, on the southern side of the building.

THE PARTING ROOM.

Gold and silver possess a strange affinity for each other. As one scientist puts it, "they seem to hunt in couples." It is the object of the refiner to separate them and remove any base metals that may also be present in the bullion, so that he can turn over to the melter bars that are 998 or 999 parts in a thousand pure metal.

There are three processes used to accomplish this separation—the sulphuric acid process, yielding gold that is about 992-996 fine; the nitric acid process, which is rather more expensive, but gives gold 997-999 fine; and the electrolytic process, which, while the cheapest of any, gives gold that is 999.5-999.9 fine. The sulphuric acid process is used at the New York and San Francisco refineries, but not in the Philadelphia Mint. Here the nitric acid process is mainly used, although an electrolytic plant for parting gold has been installed recently.

THE NITRIC ACID PROCESS.

The nitric acid process is the oldest, and was, until a comparatively recent date, the only method used for parting gold and silver. In the fifteenth century some Germans at Venice earned the title of "gold-makers" by extracting gold from Spanish silver by this process and keeping their art a secret.

The fundamental idea is to separate the gold from the silver by treating the bullion with nitric acid, which will dissolve the silver and leave the gold unaffected. This solution of the silver is in turn treated with salt water and zinc, and the silver thus separated.

In order that the acid act satisfactorily on the bullion it has been found that there must be present a certain proportion of some base metal to each certain amount of gold. At the Philadelphia Mint the proportion of gold to silver or copper, used as the base metal, is one to two and one-third. After the necessary calculations have been made the deposits are assorted into melts of about 4,000 ounces each.

The melts are brought to fusion in one of the furnaces at the end of the room. A workman then ladles the molten metal out with a long-handled dipping cup and pours it from a height of about three feet into a tub of ice water. The cup is given a swirling, wavy motion. This treatment causes the metal to form into flaky granules and hollow spheres, not unlike pop-corn in appearance, the object being to present as great a surface as possible for the action of the acid. The granulations are placed in porcelain vessels of about thirty-three gallons capacity. These vessels have been in use at the Mint for years and were originally imported from Germany. The vessels are half filled with nitric acid, and a dozen of them placed in a large water bath in what is called the parting house. Steam is admitted to the water surrounding the vessels, and every twenty minutes the sides of the parting house are opened and the contents of the vessels stirred with wooden paddles. The solution is kept gently boiling for about six hours, in which time most of the silver will have been dissolved and the gold left as a dark brown granular sediment. The solution is siphoned off, more acid added and the process repeated.

The separated gold is washed several times by decantation. It is then placed in a portable filter and water run through it. The portable filter is a lead-lined tub with a perforated false bottom covered with cotton cloth, the whole being mounted on a truck. To render the gold as fine as possible it is transferred from the filter to one of the cast iron pots under the hoods at the end of the room, where it is boiled in a strong solution of sulphuric acid. It is a peculiar phenomenon that strong sulphuric acid will not affect iron, while it will dissolve silver. On the other hand, dilute sulphuric acid will affect

MELTING FURNACE

iron, but has no effect on silver. The silver, if any still remains in the gold, will therefore be dissolved, while the iron pots containing the solution are not affected by years of use. After a careful boiling the acid is siphoned off and the gold carefully washed again. It is then dried and melted. About 6,000 ounces constitute such a melt, the result being some fifteen bars of a fineness of .998 or .999, and worth about $8,000 each—a good forearm lift.

PARTING ROOM

The silver solutions and wash waters from the above processes are poured into a large raised vat of some 2,000 gallons capacity. Salt water is then added and the mixture continually stirred, changing the greenish fluid into a milky-looking substance. The chemical change is from silver nitrate to silver chloride. This milky fluid is drawn off through a large stop-cock into a filter, a tank about a foot deep, with a perforated false bottom covered with cotton cloth like the portable filters. The liquid drained off is returned several times to the filter and fresh water is run through, after which the chloride, looking now like curds, is scooped out with a copper scoop shovel and put in the reducing vat. This is another low lead-lined tank. Here hot water is run on and granulated zinc added. The zinc takes the silver's place in the chloride, forming zinc chloride and leaving pure metallic silver.

The reduced silver is scooped out and filtered like the gold and washed with hot water. It is compressed into hard, round cakes by hydraulic pressure. These cakes look like ordinary lime, but if they are scratched with a penknife the metallic lustre of the silver is apparent. The cakes are dried in a current of hot air and are melted, the resulting bars having a fineness of .998 or .999.

THE ELECTROLYTIC PLANT.

The gold electrolytic plant at this Mint is the largest in the world. The process is a rare one, there being but few other plants. In Germany, where it was discovered, there are only two plants, neither as large as this. Many advantages are presented by this process over others. It is simple, only one attendant being required for the whole plant, while the nitric acid process requires a dozen skilled workmen in its different steps. The parted gold is purer and the process in every way cheaper than others. There are none of the dense fumes which accompany the nitric acid process. Platinum, which is as valuable as gold, is occasionally found in deposits. It is entirely dissolved and run off into the sewer by the nitric acid process, and partially so by the sulphuric acid process; but by the electrolytic process it would be practically all saved. The process is limited, however, by the nature of the bullion received, which must be within a certain range of fineness. For this reason only about one-fourth of the gold refined at the Mint is refined by this process, though the plant has a capacity for doing five or six times this amount. So far it has been found impracticable to apply the process to silver parting, though experiments towards advance in that direction are constantly being made.

The electrolytic process for refining gold very much resembles the common copper-plating process. The gold is cast into small rectangular bars and

hung in series, by metal lugs that are cast with them, in an acid solution. These are called the anodes. Series of blank metal plates are hung opposite to them to receive the parted gold. They are called the cathodes. A current of electricity is run from the anodes through the acid solution to the cathodes, and, exactly like the copper in the copper-plating process, particles of gold travel with it and are deposited on the cathode. This is then scraped off, a rich reddish brown mass.

ELECTROLYTIC PLANT

An assay of steel and cast iron would show little difference in constitution, yet their qualities as working materials are vastly different. Gold presents a similar nature. The presence sometimes of a tenth of a thousandth part of some foreign material will make it tough, or, maybe, as brittle as glass. It takes a very expert man to detect this state of affairs in the raw bullion, and even then it is not always possible. In such cases it is fluxed with nitre through an "eye" in a cover of bone ash. The nitre oxidizes the foreign substances, the product being absorbed by the bone ash cover. The foreign

mints do not, as a matter of general practice, refine their own metals. As a consequence they occasionally receive metal that is brittle, necessitating the refining of it themselves at a comparatively large expense. The United States refines all its gold and silver itself. The output of refined metal at the Philadelphia Mint averages per day by the electrolytic process $16,000 and by the nitric acid process $23,000 or $24,000.

The parting room shows many of the advantages of the new Mint building over the old building. While the plant's capacity has not been materially increased, aside from the perfected electrolytic plant, the new conveniences are apparent in every operation. Much more space has been given to the department. All the different steps of the nitric acid process are made in one room, where before they were made in different parts of the building, the materials being carted in trucks from one room to another. The furnaces are all heated by naphtha gas, allowing an exact regulation of the temperature, which is quite an important element with the sulphuric acid cauldrons, considering the acid's action as noted above.

SULPHURIC ACID CAULDRONS

In one of the rooms of the Refining Department there is a large steel vault where the granulations are stored and the finished metal kept pending its transfer to the other minting departments.

The gold and silver when it leaves the Refiner's hands is ready for issue to the public for industrial purposes, or to enter on its next stage in the coinage operations. There is much more gold and silver used in the industrial arts than is generally supposed. The output from the New York Assay Office and the Philadelphia Mint in a single year, to jewelers, gold beaters,

watch-case makers, etc., amounts to about $18,000,000.00, aside from the $5,000,000.00 worth refined by private individuals.

THE MELTING ROOM.

In order to make it hard enough to stand the wear and tear of usage as coin it has been found necessary to alloy some other metal with the gold and silver. Our government requires that standard coin shall be composed of 900 parts of gold, or silver, and 100 parts of pure copper. A very slight variation, a fraction of one per cent., is allowed. The alloying of the metals and the casting into ingot bars is done in the melting room.

This department is the first one shown to the visitor. From the gallery one sees a large room, with low glowing furnaces just below, and a busy force of men handling ladles full of precious metals, or bars of it looking like foot-rules. It might open the visitor's eyes to be told that this foot-rule is made of gold and is worth $1200.00, or that each of those whiter ones that another workman is piling up on a truck is silver and valued at $60.00.

There are sixteen furnaces used in this operation, each furnace containing but one crucible, or melt, at a time. A silver melt will contain about 3800 ounces, valued roughly at $3600.00, and composed, probably, of 2000 ounces of pure silver, 1300 ounces of strips, edges and condemned blanks returned for remelting by the Coiner, and 500 ounces of copper. This mass is kept at a heat of 1800°. A gold melt will contain about 6000 ounces, valued at $130,000.00, and is maintained at a temperature of 2000°. In both instances it takes about three-quarters of an hour to properly fuse the metals. The life of a crucible in such a heat is not very long, the average crucible being broken up after three or four days' use. The crucibles are made of plumbago and clay, and cost the government about $2.60 apiece.

Thirteen of the sixteen furnaces used here burn naphtha gas. These furnaces possess many advantages over the coal furnaces used in the old Mint. They are much cleaner since they make no ashes. This is one of the main reasons assigned for the decrease in the amount of "sweeps" after moving to the new building. The desired heat can be quickly reached and steadily maintained. It follows that they are quicker and more economical than the old furnaces. Five melts are made in one furnace to-day where previously there were four.

An attendant occasionally mixes the metals in the crucible with a long-handled tool, not unlike a churn dasher. When the melt is properly fused it is ladled out of the crucible with a little black lead triangular shaped cup, which is held by a long pair of tongs. As this "dipping-cup" is lifted out of the crucible a shower of sparks will be seen to fly around. These are the grains of powdered charcoal which are put over the melt to keep any of the

MELTING ROOM

metal from oxidizing. The molten metal is slowly poured from the "dipping cup" into upright molds, of which some twenty are placed in a shallow iron pan near the furnace. As the metal touches the mold the grease, with which it has been rubbed like the butter on a bread pan, burns in a little flame. When the mold is filled it is passed on to a helper who opens it and throws out the two red hot ingots. These are chilled in a tank of water and dipped in a very weak solution of sulphuric acid. The "gate" end of the ingot is then cut off in a "topping machine," and the little fringe left along the parting line of the mold is filed off by hand. The molds consist of three pieces clamped together by a band and set screw. The outer pieces are recessed to form the ingots, while the center piece merely forms a partition between the two ingots. The bars are so cast that they are slightly pointed at one end that they may be easily fed into the rolling machines. After the ingots are finished at the filing press, they are piled on trucks and stamped with the melt number ready for transfer to the Coiner.

Before leaving the Melter, however, an assay must be made of every melt. If it is not of the required 900 parts fine, it is condemned, and melted over again.

In the case of gold a small chip of the metal is sent to the assayer. In the case of silver, however, we are met with a phenomena called "segregation," which causes the Melter a great deal of difficulty.

In a single melt of silver it has been found that a piece from one part will assay to a different fineness than a piece from a different part of the same melt. In an ingot bar, for instance, running through the center will be found a core of richer metal than along the outside. Silver, however, that has been granulated by dropping in cold water presents fewer evidences of segregation than in any other form. Granulations are therefore made at the beginning and end of every melt, and these are sent to the Assayer. It may be that these would be reported as 900 fine. If this were the case the ingot bars made from the melt would probably be over 900 fine in the center and less than 900 along the edges. When they were rolled and the blanks punched, the coins would be made out of the meat of each bar and would be over 900 fine, while the clippings returned to the melter purporting to be 900 fine, in fact would be below that standard. For this reason in handling silver the Melter aims, in his calculations, at an ingot bar that will be between 898 and 900 parts in a 1000 fine. Coins made from the center of such an ingot when rolled will then be just about 900 fine.

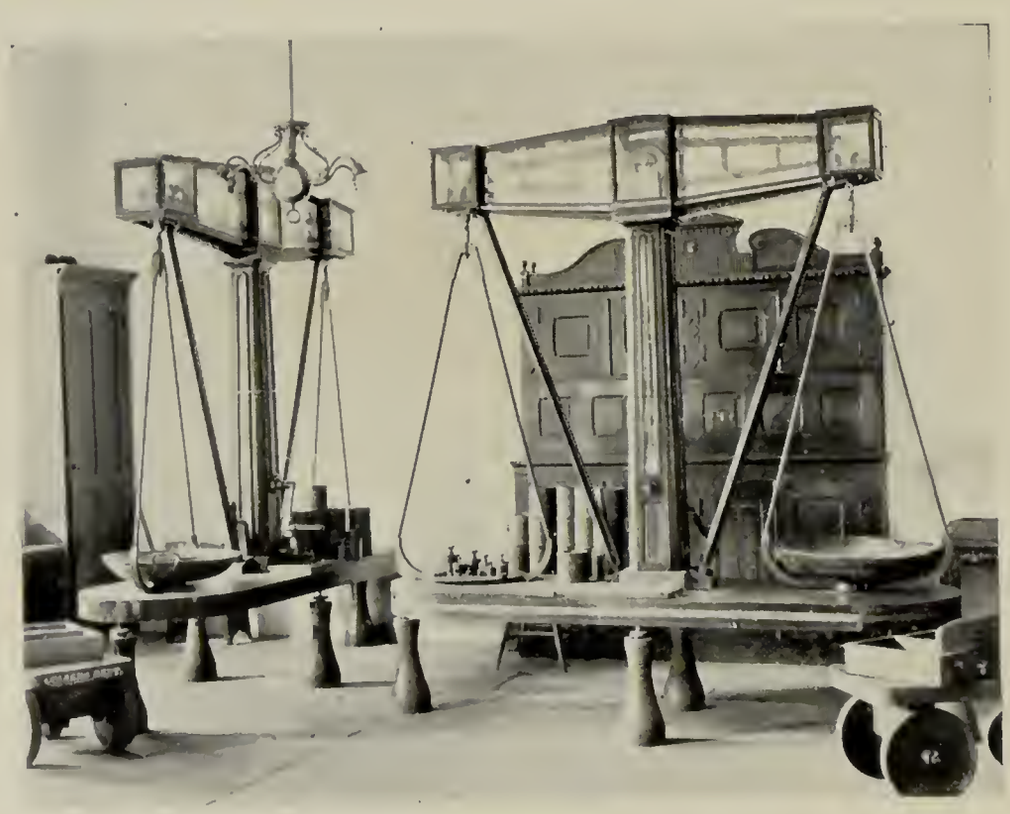
A peculiar construction will be noticed by the visitor in the floor of the melting room. It is covered with an iron honeycomb grating, made up in sections of about a foot in diameter. This grating serves as a continual scraper on the men's boots. The sections are lifted out at the close of each

day and the floor swept. These sweepings are gathered together, mixed with a flux, and placed over night in one of the crucibles that is about worn out. In the morning the crucible is broken and a "king" of metal will be found below the glassy coating of the flux. This king is weighed, credited to the melting room and sent to the Refiner.

In the melting room we see instanced the scrupulous care with which the Mint follows ever speck of precious metal. A strict record is kept and the melting room is charged with the weight of all metals sent into it in the morning. At the close of work for the day and before the men are dismissed, all returns from the room, ingots, tops, filings, are weighed and any shortage noted. This record, of course, is never exactly the same as the charge sent out, but experience has shown about what per cent. will probably adhere to the crucibles and be otherwise converted into sweeps and allowance is made for this in making up the day's return.

THE TRANSFER WEIGH ROOM.

When the Melter has completed the ingot bars and the Assayer has passed on them as of proper fineness, they are taken to the Transfer Weigh Room, the room referred to above as that in which the bulky deposits were



LARGE SCALES

weighed. Here there is a representative of the Superintendent, of the Coiner, and of the Melter. The ingot bars are placed on the scales, the Superin-

tendent's deputy reads off the weight, the Melter's deputy agrees, and the Melter is credited on the Superintendent's books with that amount of metal. The Coiner's deputy agreeing to the reading, the ingot bars are turned over to him and the Coiner is charged by the Superintendent with that amount. So with all transfers between these departments. When the Coiner returns strips from which blanks have been cut, or blanks that are under weight, they are weighed in this way and one department charged while the other is credited.

When silver is being coined, $100,000.00 worth in a day is not an unusual amount to be weighed on these scales.

VI.

The Coiner

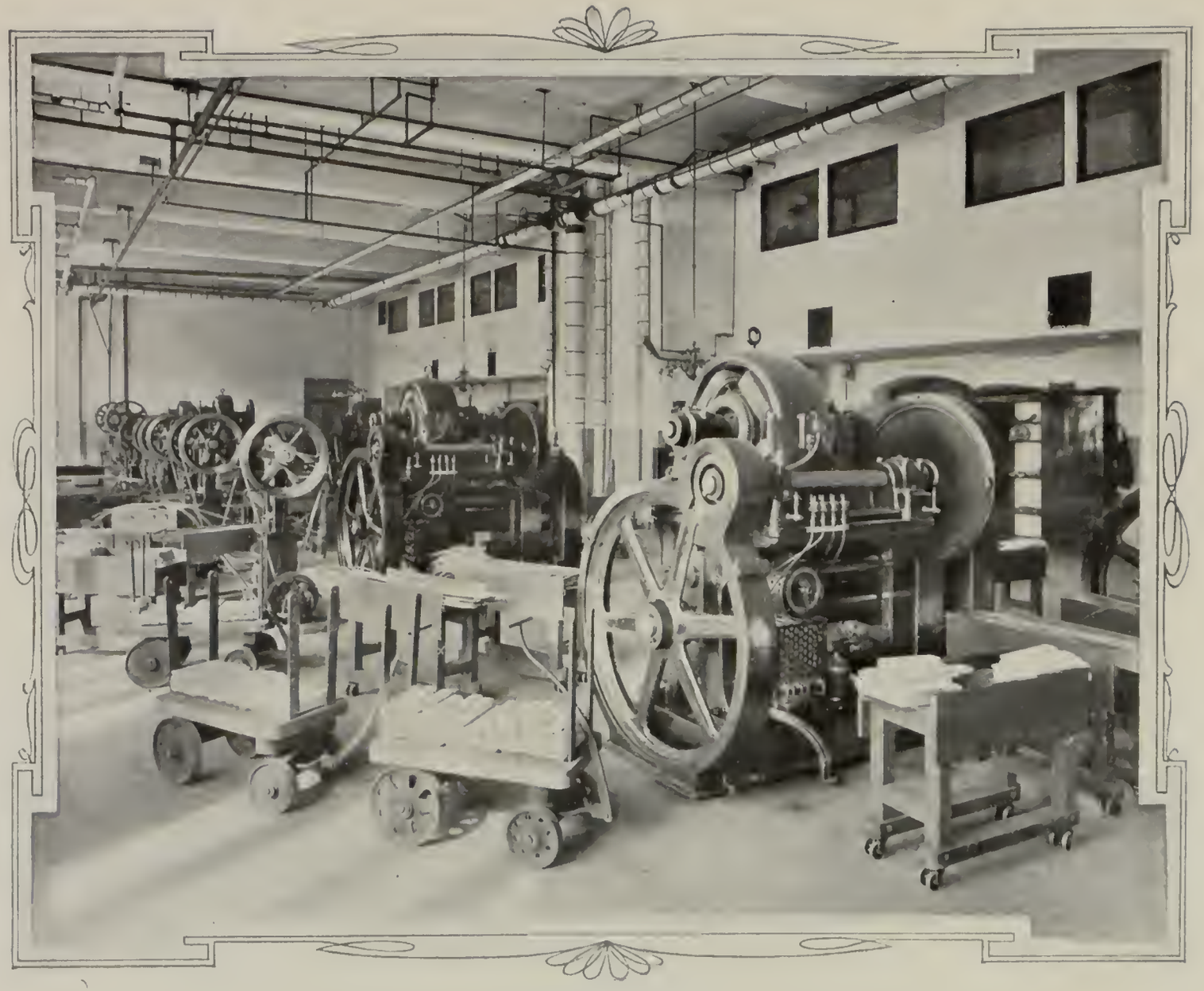
THE ROLLING ROOM.

The next step towards the finished coin after the ingot bar of standard metal has been made is to roll the bar into strips of the proper thickness and cut from them the blanks or planchets. This is done in a large room running along the southern end of the building on the main floor. The spectator in the gallery may hear a dull rumbling noise through the windows; inside the room, however, the din is deafening despite the fact that improvements have lately been added to the machines doing away with a great deal of the racket.

COINER'S OFFICE

The ingot bars are now reduced to strips of the proper size on the rolling mills alone, the old draw bench with its greasing, pointing, and cleaning, being done away with. There are two types of mills, the break-down mills, through which the ingots are first run, and the finishing mills, which roll the strips to the required size. There are six of the former machines, each equipped directly with a fifty-horse power motor, and three of the latter, which are run by motors of less power.

The ingot bars are carried in trucks to the face of one of the break-down machines and fed one at a time by the operator between the chilled iron rolls. If two should happen to be fed at once a switch is automatically thrown, immediately stopping the machine and thereby saving it from what



ROLLING ROOM

would necessarily be great damage. The rolls can be adjusted by means of a clock dial on the front of the machine to five ten thousandths of an inch.

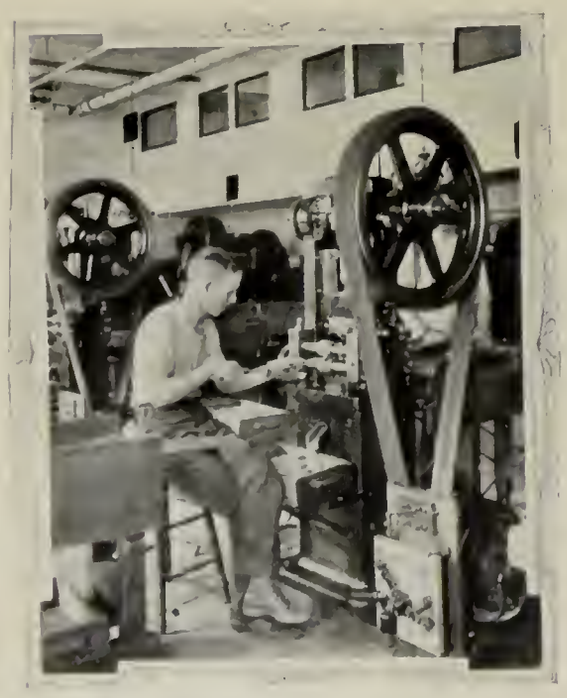
It requires forty horse power to reduce a four-foot strip, that is an inch and a half wide and five-eighths of an inch thick, .045 of an inch in one pass. It is not strange then that there is a great molecular change apparent after an ingot has been run through a mill eight or ten times. It becomes very brittle. To restore its ductility the strip is annealed in one of the strip annealing furnaces which will be described later.

After the strips are annealed they are returned and rolled several times more in the finishing rolls. Sample blanks are struck from the ribbons of metal and if these are of the proper weight the rolling process is ended.

Several experiments are now being carried on aiming at the further development of this department. It is found that the chilled iron rolls chip after about six months' use. A pair of steel rolls are being tried in one of the mills. The former cost $70.00 a pair, where the latter cost $1200.00, so that the economy of the change is still a question. At present the break-down mills are run at a velocity of 113 feet per minute, and the finishing mills at 142 feet per minute. Experience has shown that the best results are obtained at the higher speeds, so that these speeds will be increased. Experiments are also being made to do all the break-down and finishing work on one mill. Another proposed change is to roll strips wide enough to cut two half dollars, three quarter dollars, and four dimes, in gang punches, where now the half dollars are punched from a strip just wide enough to yield a single row of blanks, the dimes and quarters being cut in double rows.

THE MULTIPLE SHEARS AND CUTTING PRESSES.

After the strips have been rolled to the proper thickness they are cut into shorter strips in order that they may be more easily handled. This is done on the powerful multiple shears which are capable of cutting ten gold or silver strips at a time. The knives are made of hardened steel and can be removed for regrinding or replacement.



CUTTING PRESS

The finished strips are now fed into the cutting presses which punch out the blanks or planchets on which the coin is to be stamped. The eight presses used here were designed and built in the Mint's machine shop. A single machine will cut 173 blanks in a minute. In the case of quarters and dimes, which are stamped in a double row, there would be stamped twice this number.

THE STRIP ANNEALING FURNACES.

One of the greatest improvements in the equipment of the new Mint are the strip annealing furnaces. It was their installation that marked the substitution of the rolling mills for the draw bench, a change which is credited with a saving of twenty-five per cent. in condemned silver blanks.

The proper annealing of gold and silver and their alloys is one of the most difficult of mint problems. In constructing these ovens allowance had to be made for the extreme heat which will cause the parts to expand, and

STRIP ANNEALING FURNACES

rapidly deteriorate. Provisions had to be made in order that the heat might be regulated to suit the different metals; that the metals should be heated in all parts at once, not depending on conduction to equalize the temperature; that the metal might be withdrawn as soon as the heat had been evenly distributed, and had penetrated all parts of the strip. The present machine is admirably adapted to accomplish all these purposes.

In a room adjoining the rolling room, and beneath the Cabinet are eight of these annealing furnaces—metal boxes about ten or twelve feet long and standing about breast high. A long shaft running along the outside of the furnace keeps a series of rolls inside revolving. The strips, five or six across, are placed in ridges in these rolls and are slowly carried through over a series of naphtha gas flames, which allows a perfect regulation and distribution of heat. In order to prevent oxidation, the strips, before emerging at the other end, enter a hood charged with a surplus of gas. For this purpose also, a spray of water is run on them before they come into the air. When the strips appear, they are cooled to such an extent that the operator can grasp them with his bare hands. With the old wood furnaces from three-quarters of an hour to twice that time was consumed in heating the metal and allowing it to "soak," where now a strip of gold is in the fire approximately six minutes. Instead of being put directly into the furnace the gold strips were encased in copper canisters so that none of the precious metal might be lost in the fire, and oxidation might be prevented. The oxidation of the silver which was placed bare in the furnace under the old system necessitated a subsequent acid bath.

ROLLING ROOM VAULT.

Connected with the rolling room, and situated between it and the transfer weigh-room is one of the several steel vaults used by the various departments in storing metals in transit from one department to another. On shelves, like book-shelves, around the inside of this room are piles of ingot bars ready for rolling. Truck loads of ingots are brought here from the melting room after being weighed. The stranger picks up a bar about the size of a thick foot rule, though a good deal heavier, and is told that it is fine gold worth about $1400.00, and that double eagles will be made from it. Here is another, slightly narrower, from which eagles will be coined. It is valued at $1000.00, and so on, the half eagle ingot being worth $750.00, and the quarter eagle ingot $575.00. A silver dollar ingot will produce $40.00 in either dollars or dimes. A half dollar ingot will produce twenty-six dollars and a quarter dollar ingot forty-five dollars. Hundreds of thousands of dollars' worth of ingots pass through this store room daily.

THE SELECTING TABLES.

After being stamped out in the cutting presses the planchets are weighed by the Coiner and sent to the selecting tables. Here a half dozen employees pick from the mass of blanks all those that have rough or nicked edges,

flattened sides or any other apparent defect. Seated at a small desk or table the operator spreads out a handful of the blanks, and with remarkable rapidity segregates the imperfect blanks and pushes them into a slot in the table, while the perfect blanks are put in another slot. The operators say that their skill is not due to exceptionally good eyesight, but rather to a sense of touch and keenness of vision for these particular defects acquired by long experience in discovering them. The condemned blanks are returned to the Melter for re-melting while those that are approved are taken into an adjoining room, where they are fed into a machine that automatically assorts them.

THE AUTOMATIC WEIGHING MACHINES.

One of the most interesting of the many wonderful inventions to be seen in the machinery at the Mint are the six automatic weighing or assorting machines which were designed in Austria over twenty years ago. A deviation of a grain and a half is allowed by law in the weight of every silver dollar. The automatic weighing machine weighs the coin and throws those that are too light in one box, those that are too heavy in another, those within the allowed limit, though heavier than required, in another, and those within the limit, though light, in another.

The machine is made up of a row of delicately adjusted scales enclosed in a glass case. The operator sits in front of it and feeds the blanks into a row of ten brass tubes, that many blanks being weighed and separated at once. A feeder slides out, carries the coin from the bottom of each tube into the machine and drops it into a little metal basket. There is a moment's pause and then a jingle, as the ten blanks are dropped into the channels beneath the machine. The channels lead to cans on the floor which receive the blanks of the four different weights. Four of the machines weigh silver dollars, at the rate of forty a minute. The other two weigh half dollars, fifty of which are separated every minute. Despite this rapidity the machines weigh to the fraction of a grain. The blanks weighing less than 411 grains are condemned and returned to the Melter, while the rest are carted in trucks to the adjusting room.

THE ADJUSTING ROOM.

In a large room on the western side of the third floor of the working portion of the building are some sixty women, seated at tables in long rows, each before a fine balance, weighing and adjusting blanks and coins. The blanks are weighed by the operator, and if found slightly heavy are filed a

AUTOMATIC WEIGHING MACHINES

little from the edge till they are made the proper weight. If they are too light, or too heavy for filing, they are placed in a separate can to be returned to the Melter. Finished coins are also brought back to this department and re-weighed to guard against the issue of any coin that might be of false weight. At the end of each day the filings made by each employee are collected, weighed and sent to the Melter.

THE UPSETTING MACHINES.

It has been found that when a rim has been raised around the edge of a coin the surface of the face is protected from abrasion and the life of the coin lengthened. This little edge or collar is generally, though, as the Superintendent of Machinery points out, incorrectly, called the milling. The edge

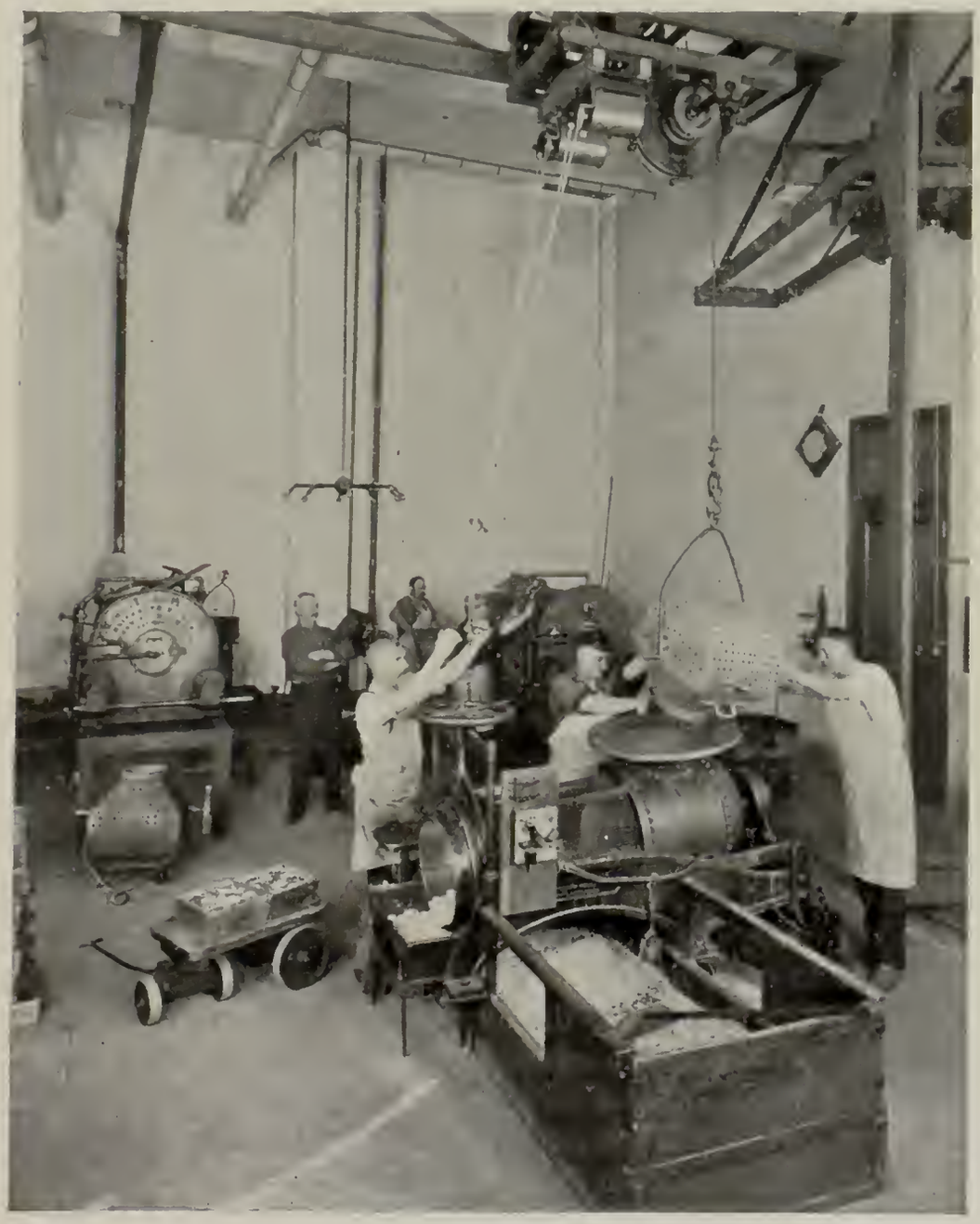
UPSETTING MACHINES

is rolled up in what should be called the upsetting machine, a machine that was re-designed and built in the Mint's shop. It is a circular machine standing about as high as one's waist and run by a vertical motor in the lower part. The blanks are fed into two tubes at either end of the diameter of a circular steel plate which is about two feet across. A little feeder pushes the coin in between two grooves, one in a plate revolving in the center of the machine, the other in the outside stationary plate. The blank makes about three revolutions in these grooves and is dropped out. It will be seen that the pressure on its edges has raised a regular edge around the disc. There

ADJUSTING ROOM

are nine upsetting machines in the new Mint, one for each coin minted, excepting pennies and nickels, the blanks for which are received already upset. The old mills had several sets of grooves in a single mill for coins of different denominations. One of these machines will upset 464 dollar blanks in a minute, or 676 blanks for dimes.

THE WHITENING ROOM.



WHITENING ROOM

After being upset the coins are practically ready for the coining press, being of the proper fineness and standard weight. However, all the handling

the blanks have been subjected to in the selecting, weighing, adjusting, and upsetting has made them soiled and dirty. To clean the coins, and to make sure that the metal in them has not become too hard or tough to work, the blanks are thoroughly cleaned and annealed. This is done in the Whitening Room.

The annealing is done in a machine called the rotary annealer. The blanks or planchets, which have been brought here on trucks from the upsetting machines, are fed into the top of the furnace, which is cylindrical in shape and stands about six feet from the floor. Peering into a little vent near the top one can see the coins being moved slowly, through the six feet of flame, to the back of the furnace; here they drop and commence a journey back again, finally falling into a large metal basket beneath the furnace. In the case of gold the blanks are dropped directly into water and an excess of gas is used to prevent oxidation. There are two rotary annealers, capable of annealing 100,000 silver dollar blanks in eight hours.

To clean the blanks they are dipped in a tank of weak sulphuric acid and dried in a machine called a revolving riddle. In this machine the planchets are heated and rolled around in bass wood sawdust, a large box of which is seen below the riddle. This wood is used as it has been found to have less rosin in it than any other. The discs are run down through a current of dry hot air through an open part of the machine and are poured out bright and shining. The whitened planchets are then ready to receive the government stamp to make them money.

THE COINING PRESSES.

Coins of all denominations are made at the Philadelphia Mint. All the nickel and bronze pieces used in the United States are made here, alone amounting to over a hundred million pieces in a year. The stamping of the design on the coins is done on the twenty-five coining presses seen by the visitor in the western side of the building on the second floor. An idea of the comparative work of this mint is gained from the fact that there are more presses here than in all the other government mints together. Until recently there were but nine other coining presses. Ten new presses were installed when the mint was moved into its new quarters. These presses, together with two of the powerful rolling mills, were built at the shops of the T. C. Dill Machine Co. in Philadelphia.

The dies are adjusted in the coining press by a skilled operator, the adjustment requiring the services of a man of long experience. The blanks are then fed into a tube at the front of the machine. In doing this the women who feed the machines shake the blanks in the palm of their hand, getting

COINING PRESSES

them in a column ready to go in the tube, and incidentally detecting any false or nicked blank that may have escaped the vigilance of the workers at the selecting tables. A pair of fingers takes the disc from the bottom of the feed tube and carries it in between the upper and lower die, where it is held in position by a collar, the inner edges of which are grooved. The stamp then descends. The obverse of the coin is struck on the top of the blank and the reverse on the lower side. The pressure flattens the coin out squezing it into the grooves or nicks in the collar and making the delicate reeding seen on the coins. The reeding is intended to prevent any of the metal from being filed off without detection. When the pressure is released the lower die forces the coin out of the collar and the fingers force it back into its channel, at the same time carrying a new blank into the collar. Despite the fact that many tons pressure are put on each coin stamped, as will be seen in the table below, this whole operation is done in a moment, and from 80 to 100 coins are thrown into the can at the bottom of the machine every minute. The quarter dollars and coins above this denomination are stamped at the rate of 90 per minute, under this denomination the coins are stamped at the rate of 100 per minute.

DENOMINATION*	TONS PRESSURE.
Double Eagle	155
Eagle	110
Half Eagle	60
Quarter Eagle	35
Silver Dollar	160
Half Dollar	98
Quarter Dollar	60
Dimes	35
Nickels	60
One-Cent Piece	40

*These pressures represent the mean pressures of the different coining presses, which may vary as high as 5 per cent. from this amount.

THE RINGING ROOM.

After the coin has been finished it is again taken to the adjusting room, as has been stated, where any piece that deviates from the standard weight more than is legally allowed is set aside and sent to the Melter. One step more, however, is required before the government will issue the coin as money. This is the test for resonance, or ringing. Partitioned off from the bustle of the adjusting room is a small room where two women sit dropping

coins rapidly, one after the other, on a metal plate. It may be that some one of the coins has a bubble or hollow spot inside, and yet has passed the test of weighing being larger or denser than the average. If such a defect exist it will be detected at once by its false ring and set aside. Every silver dollar coined is rung in this way and defective ones are occasionally found.

COUNTING.

Before turning the finished money over to the Cashier it has all to be counted and packed in bags with the amount stamped on them. This is done in the end of the large room in which the coining presses are and in the small room adjoining to the north.

Before observing the counting, however, the attention of the visitor is first called to the large scales in the end of the Coining Press Room. These balances are like those used for the weighing of bulky deposits, and transfers of metals in the Transfer Weigh Room, having the same capacity ranging from 10,000 ounces to the one hundredth part of an ounce. We see the weigher put a great pan filled with blanks on the left hand side of the scales, and a number of large brass weights and small aluminum ones on the right side. By turning a large crank the beam is lifted from its "saddles" or rests. A knob is pushed in at the bottom and the needle, about four feet long, swings over a scale about two inches long, towards the lightest side.

After each working or process, the charge of metal issued by the Superintendent is weighed, so that any abstraction would be immediately noticed and its origin traced. Gold goes through about twenty such processes and weighings, and silver about fifteen. Yet, despite its frequent changes in character and form, a loss of but half an ounce in gold and an ounce in silver in every thousand ounces is allowed by the government for abrasion.

To return to the counting, all the gold coinage, and the silver dollars, are counted by hand, the coin being piled in stacks on the counting tables. The minor subsidiary coins are counted on the counting boards. The visitor in the gallery can see these simple labor-saving devices being used in the northern end of the Coining Press Room. They are boards with parallel brass ridges, raised the height of the thickness of the coin to be counted and running the length of the board. The board is rested on supports over a big funnel and the coins to be counted poured over it. The workman then tilts the board so that all the coins slide off excepting those between the metal ridges. He then drops the end of the board, which is swung on hinges at the proper length, and in the case of pennies one thousand coins are counted in the fraction of a minute. The board full of coins is then emptied into a channel running into a drawer from which the bags are filled.

As has been stated, some coins, while within the government tolerance, are lighter than the standard weight. On the other hand, some are heavier than the standard. We have, then, what are known as "heavies," "lights" and "standards."

The gold coin is put up in bags of $5000.00 each. This amount of gold coin should weigh 268.75 troy ounces. If the coins put in a bag, however, were all "lights," this amount would not be reached. The law requires that the weight of such a bag shall be within one one-hundredth of an ounce of being this amount. The counter, therefore, has to mix the "lights," "heavies" and "standards" in such proportion that the legal weight for each bag is reached.

NEW COINING PRESS

Silver is put up in bags of $1,000.00 each. Such a bag of dollars should weigh 859.375 troy ounces, or if in subsidary silver 803.75 ounces. The different weights have here to be mixed so that there shall not be a deviation of more than one one-hundredth of an ounce in the case of dimes, or two one-hundredths of an ounce with the other silver coins.

On an average day this department will weigh and count $140,000.00 worth of money. After it has been counted and packed in the bags it is stored in the Counting Room vault ready for transfer to the Cashier and issue to the public.

VII.

The Cashier

The channel through which the newly minted coins pass from government control to public use is the Cashier's office. Situated to the left of the main entrance, it is equipped with all modern conveniences for the employees and the public. With doors that are self-locking, windows that are guarded with wire netting and vaults finished with the most approved burglar defying doors, the office seems impregnable.

When the Coiner is ready to make a delivery of new coins, he notifies the Cashier. Before the coins are accepted it is the duty of the last named official, acting for the Superintendent, to ascertain, by weighing a number of pieces taken indiscriminately from the delivery, whether the coins are within the legal limits of the standard weight; if the weights are correct the coins are ready for distribution. To learn whether the coins are of proper fineness pieces are also reserved for the Assay Commission, appointed annually by the President. Scientific examination by these experts invariably proves that the gold or silver is of legal fineness.

The five cent (nickel) and the one cent (bronze) pieces are all issued from the Philadelphia Mint. The blanks are purchased under contract and the million of little pieces sent out yearly are all stamped in the building. The presses are constantly running on these coins, as the demand from the country is a never-ceasing one. The cashier ships daily to banks and business firms throughout the United States thousands upon thousands of the nickel and bronze pieces, the demand being particularly heavy during the weeks preceding the Christmas holidays.

For the work thus done the Cashier has two office assistants, a shipping clerk and five or six packers. The demands for new gold and silver coins come principally from the Sub-Treasuries throughout the country, their vaults being constantly replenished from the Mints' great stores. All shipments are made under the supervision of the Cashier.

Visitors to the Mint invariably find their way to the Cashier's office before leaving the building. The visit is not complete unless some newly-minted coins are carried away as "souvenirs," the bright cent generally catching the fancy of the stranger. The favorite coin, though, is the quarter eagle, the little gold piece being in particular demand for Christmas and school presents. Occasionally a happy-looking young male visitor asks for "a bright new double eagle," and it is safe to say it shortly after warms the palms of an officiating minister at some one's wedding. Altogether, the office of the Cashier is a study for the visitor to the Mint.

VIII.

The Assayer

On the top floor and occupying a half dozen rooms in the northeast corner of the building is the Assay Department. The object of the assay is to determine the fineness or quality of the gold and silver, both in order to base the calculations for value and subsequent minting operations. The balances used in this department are sensitive to less than the one three-thousandth part of one grain. Every deposit of bullion received at the Mint must be assayed, and likewise every melt cast by the melter must be passed on by this department. The gold is assayed by the "dry" or "furnace" assay. Silver is assayed by the "wet" or "humid" process.

ASSAYER'S OFFICE

ASSAY OF GOLD.

In the majority of cases the gold received at the Mint is alloyed with silver and a small proportion of some base metal. The object of the assay is to ascertain the fineness or quality of the gold, as well as the proportion of the other metals present. In order to do this the assayer weighs a certain amount of the sample and then proceeds to extract the silver and other foreign substances. When this process of refining is done the metal is weighed again and the proportion of gold in the original is thus ascertained. The amount of the base metals present is determined by placing another sample of the alloy

in a bone ash cupel and heating it. The base metals will be oxidized and pass off as fumes or be absorbed in the cupel. The difference between the original weight of the sample and that after the base metals were removed will show the proportion they formed in the metals in the alloy. The silver present will be found by the difference between the sum of these two amounts and the weight of the original sample of the alloy.

If the gold alloy has been properly melted a small piece from it will have the same fineness as the rest of the bar. A small chip is therefore taken from the metal to be assayed and is beaten out into a strip so that it may be more easily chipped. One demigramme (rather less than eight grains) is then accurately weighed from the laminated strip. This is done on the delicate scales referred to above, on which the adjustment is so fine that they are sensitive to the fiftieth of a milligramme. Gold is spoken of as so many parts in a thousand fine. This demigramme, then, if of pure gold, would be one thousand fine.

As in the refining of gold, it is here found necessary to add enough silver to the alloy to make it twice the estimated amount of gold. This is settled by the operator, who, by practice, can judge of the fineness of the gold to a few thousandths. If, however, there is a large amount of base metal present, or the gold is of low fineness, a preliminary assay will be made as a basis for the subsequent assay.

The gold and silver each having been accurately weighed, are enclosed in a piece of lead foil and rolled into a bullet.

The cupellation is the process by which the copper and other base metals are separated from the gold and silver. The cupel is a small shallow cup made from the ash of bones or the pith of animal horns. The bone is well burned in the open air and thoroughly ground, after which it is moistened and pressed in a mold into the desired shape. The cupels possess the quality of absorbing the oxides of metals, but not the metals themselves.

A number of cupels are placed in a muffle in one of the gas furnaces and brought to a uniform heat. The lead bullets are then put in their respective cupels and the furnace closed. A small opening in the top of the muffle and the furnace allows a current of air to pass over the cupels. This oxidizes the lead and base metals, forming a fluid vitreous oxide, which exercises an influence on the base metals in the gold. These oxides are then either absorbed into the cupel or are carried off in fumes. When all agitation has ceased the cupel is allowed to cool slowly, is removed from the furnace and the button of pure alloy of gold and silver detached.

To separate the silver the alloy is digested in nitric acid. In order that the action of the acid may be on a larger surface the button is hammered, annealed and rolled in a small rolling mill. The resulting strip is loosely coiled

ASSAYER'S WEIGH ROOM

in a small roll, called a cornet. The cornets are placed in small cups of platinum arranged in a basket of the same material, capable of holding sixteen assays. The whole is then put in a bath of nitric acid and boiled. This operation is repeated several times to assure the separation of all the silver. The cornets are thoroughly washed with water, dried and annealed without being removed from the basket, thus assuring a uniformity of treatment to all the cornets.

The resulting cornets of fine gold are brought to the assay balance and the weight ascertained in thousandths of a demigramme. The number of thousandths which it weighs expresses the fineness of the original sample in thousandths: in other words, the weight gives the fineness of the gold.

With every assay of a sample of gold there is made a duplicate assay. This is done to guard against any error in the assay processes. It also serves to show whether the bullion is of the same fineness throughout.

With every assay or set of assays it is customary to make one or more of pure gold, as a test assay or proof of the work, to detect any possible inaccuracy from over or under heating, too prolonged boiling, etc., as well as to afford any necessary correction for same.

THE SILVER ASSAY.

The object of the silver assay is to determine the exact proportion of pure silver contained in any alloy, as bullion, plate or coin. The assay does not regard the nature or variety of the alloying metals, but simply their proportionate weight to that of the pure silver.

It is customary in securing samples of silver for assay to take granulations from the melted mass. This is effected by dipping a small portion of the melted alloy from the crucible and pouring it into cold water. This is known as granulating. The object is to secure a perfectly uniform sample of the metal.

After the granulation samples are secured they are thoroughly dried and are ready for the assayer at the balance.

There are two methods of assaying silver. The first is by the furnace or cupellation assay, where a certain quantity (one gramme or a thousand parts) of silver is weighed and fused in a bone ash cupel with the addition of pure lead: the lead oxidizes and is absorbed by the cupel together with the base metal contained in the silver. The weight of the button of pure silver remaining is the fineness of the same expressed in thousandths.

This method is liable to error, as so many precautions have to be taken to secure a correct result. It is used chiefly as an approximate assay.

The method of assaying silver as practiced in the Mint is known as the humid or wet method, to distinguish it from the furnace assay.

The principle of the humid assay is that of determining the proportion of fine silver in an alloy, by ascertaining the exact amount of a precipitant of known value required to eliminate the silver contained in a solution of a given weight of the alloy, so that the result is obtained without a final weighing of the silver. The necessary amount of the precipitating agent being found, and the weight of the alloy known, the number of parts of silver in a thousand (or the fineness) is deduced by calculation.

CUPEL FURNACES

For this purpose a solution of common salt, chloride of sodium, is the precipitating agent used.

When silver is in solution in nitric acid, and any chemical reagent containing chlorine is added, the silver at once combines with the chlorine of the agent used, forming a precipitate of chloride of silver.

The solution of salt used in the assay is known as the normal or standard solution, and must be prepared with exactness; that it must be of a certain strength.

This normal salt solution is of such a strength that one hundred cubic centimetres will exactly precipitate one gramme of silver from solution.

The process of the assay is as follows: A certain quantity of the silver is weighed on the balance; it is then dissolved with nitric acid in a bottle of about eight ounces capacity. After complete solution, one hundred cubic centimetres of the normal salt solution are allowed to flow into the bottle from the "pipette" or measuring apparatus.

The silver at once combines with the chlorine of the salt, forming a white, curdy precipitate. To hasten the settling of the silver chloride the bottle is violently shaken, generally in an agitator or shaking machine. The agitation having caused the chloride to settle as a dense white precipitate at the bottom of the bottle, the liquor (nitrate of soda) remains transparent, though it may be colored by some alloying metal.

FURNACE ASSAY DEPARTMENT

The next operation is to ascertain if all the silver has been precipitated, or whether the precipitation has been overdone, i. e., whether an excess of salt remains in the bottle.

Accordingly the bottle is charged by a small hand pipette with a measure (one cubic centimetre) of salt solution, but of only one-tenth of the strength of the normal solution.

If the normal solution were not sufficient to precipitate all the silver there will, upon allowing the decimal dose to run gently down into the solution, be a white cloud formed upon the surface of the liquid, the density of the cloud varying with the amount of silver still in solution. The assayer judges by the appearance of this cloud as nearly as possible how many more doses of the decimal solution will be required to effect complete precipitation. Having decided, he accordingly so charges the bottle, and makes a record of the amount used. The bottle is agitated again, and when the liquid is cleared it is tried as before with the decimal dose of the salt water.

If the proper quantity of the decimal solution has been added only a delicate trace of chloride will appear on the surface. This proves the assay complete.

As the original weight of the alloy is known, and also the total amount of solution of salt used, the fineness of the silver is then obtained by a simple calculation.

ASSAY LABORATORY

IX.

The Engraver

All the dies used in coining at all the United States Mints are made at the Philadelphia Mint. The small force we see employed in the four rooms on the northwest corner of the second floor and the single room on the third floor make on an average sixteen or seventeen hundred dies in a year, and have made as high as twenty-five hundred dies in that time. Most of these dies are, of course, dies for coins, many of which are stamped from a single "hub," though all the dies for the government medals are also engraved by this department. One might wonder what the government needs with so many dies, but when we consider that the average silver dollar die can be only used to strike 150,000 coins, and that these coins are struck at the rate of ninety every minute, we see that a new die will be needed every four or five days. The life of a die varies with the metal and the size of the coin it is to stamp.

A record is kept by this department of each die that has been engraved, from the date of its issue until it is returned for destruction at the close of the year. Every die, when completed, is numbered, and if the engraver should at any time want to know in whose custody a certain die was, he could easily find out by reference to this number in his record. The dies are guarded and watched by the government as closely as the boxes of coins and precious metals themselves. Every die has its own individuality, which is noted and easily recalled by its engraver, so that it would be as impossible to substitute a counterfeit for the die issued as it would be to steal one, without being immediately detected. While the dies for all the Mints are made here, those intended for the outside Mints have a small mark on them, signifying the Mint from which the coin was issued. The initial of the engraver may also be seen on the face of the coin.

There are two systems used in engraving dies. The older and simpler method of engraving directly on a steel face is used mainly in making dies for medals. The coinage dies and the more artistic medal dies are made by use of the reducing lathe and "hubbing" process.

The former process is started by selecting the block of steel that is to be the die and putting a true face on it. So fine is this work of facing that, attached to his lathe, the turner has an adjustable magnifying glass which he constantly uses while truing the surface. The engraver makes a copy of the design to be engraved the exact size it is to be in the finished piece. This is drawn in lead pencil and transferred to the face of the steel cylinder by putting a coat of wax over the latter, and then rubbing the lead of the

drawing on it. The faint lines seen are then gone over with a fine graving tool to make them permanent.

The engraver then cuts out the metal, forming the design in intaglio, so that when a coin is struck the figure will stand out in relief. From time to time as he goes along he tests his work by making impressions of the same on a lump of wax. If any part can be done better in relief, this part of the die is hardened and stamped into another piece of steel that is softened. The relief part is added and this piece of steel is in turn hardened and stamped into a softened block of steel, which when hardened is the finished die.

DIE ROOM

The second and more modern process is commenced by the engraver making a model of the design in wax about three or four times the size of the coin or medal. An electrotype is then made of the model, and fixed rigidly, with sealing wax, on the face of the reducing lathe, a wonderful little $10,000.00 machine.

The reducing lathe will make an exact reproduction of the electrotype, of the same size or smaller according to the way in which it is regulated. A long arm extends out over the electrotype. At the end of this arm is fixed a point which the operator draws over the electrotype. For every movement made with this point, sidewise, up or down, forward or backward, a similar movement is made by a second point near the head of the machine. This second point is in the form of a drill and consequently cuts out the reproduction of the large model the exact size wanted. So fine is the adjustment of this little drill that it is almost impossible to tell

whether it is revolving or not, even when a piece of metal is held against the point of it. The points or drills are made on a small machine next to the lathe. The piece of steel with the reduced design engraved on it is called a "hub."

Some parts of the design, like the date of the year, do not appear on the "hub" because the hub is used from year to year. The central design, however, stands out boldly as in the finished coin.

A piece of steel is then annealed and softened in one of the four annealing ovens, and is trued on the lathe. The "hub" is hardened and its impression struck on the annealed steel. This process, called "hubbing," is repeated a number of times. When the impression is sharp enough, the die is hardened and the temper drawn. The die is then taken to the engraver, examined and recorded.

An interesting exhibit in this room is the original design of the silver dollar with Liberty seated. It is about a foot in diameter and is colored brown and white.

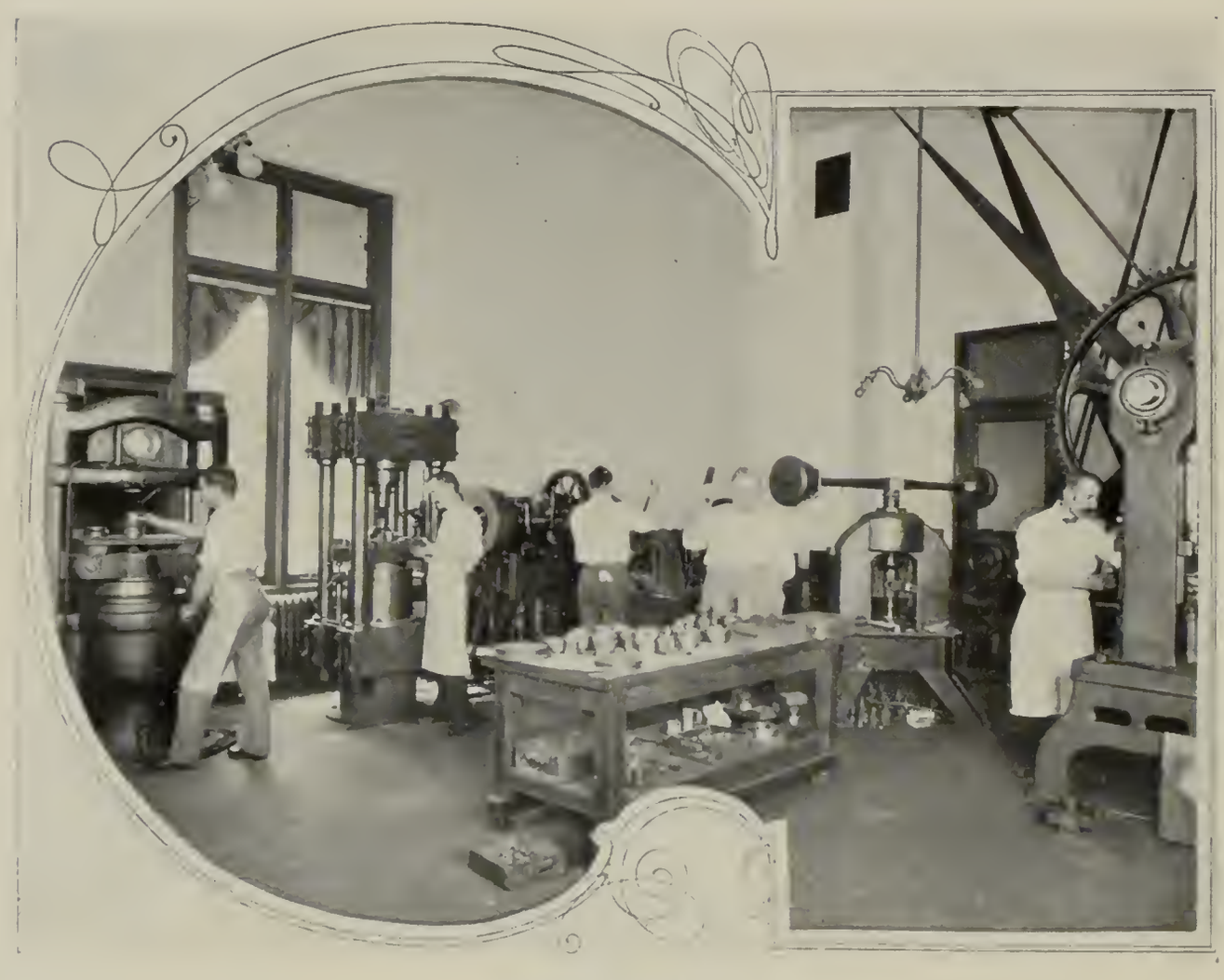
THE MEDAL ROOM.

In a single room in the southern end of the second floor of the building is the medal room, a department under the Coiner though almost an independent mint in itself. All the "proof coins" (those given a particularly fine finish) and medals are made in this room. On one side of the room is a small furnace and melting pot where melts can be made if necessary. On either side of this furnace is an annealing oven. In the center of the room is a large cutting press, which will cut dies up to four inches in diameter. Against the wall are two electrically driven hydraulic presses, capable respectively of a pressure of 400 and 300 tons to the square inch, and next to them the two hydraulic pumps. In the basement this department has a huge press capable of giving 1100 tons pressure to the square inch. This is used on the largest dies, those four inches in diameter. Off in an out-of-the-way corner is the old-fashioned hand screw press, with its long arms and heavy weights. The foreman, growing reminiscent, tells how, as a helper, he used to get these arms going round at such a gait that they would move the whole machine.

The proof sets of coins are made under the government supervision to be preserved for record, or sold to collectors. The face of the dies used in stamping these sets have been given an extra fine finish, and glisten as though they had been nickel-plated. The blanks for coins are annealed and stamped by the hydraulic press. The operator then gives them a thorough acid bath, and polishes them singly with a handful of wet sand. If they are bronze pieces, they may be given the deep bronze finish or clouded

over in the sand blast. The latter device is a small wooden box with glass sides. A pipe on the inside blows down a fine shower of sand. The operator, wearing a big pair of mits to protect his hands, holds the coin under this stream of sand until the operation is finished, when it has a delicate frosted appearance.

The six men in this department are kept constantly busy and accomplish a surprising amount of work. Besides the many proof sets of coins and government medals they stamp and finish a great many medals for different colleges and societies. The Santiago campaign medals, with



MEDAL ROOM

Admiral Sampson's head on them, some six thousand of which were authorized to be struck after the Spanish-American War, were all made here inside of four or five months.

The collection of medal dies which are shelved in a closet in one corner of this room is very valuable and interesting. There are over three hundred dies here; a complete series in honor of the succeeding Presidents of the United States, in honor of heroes of our different wars, of inventors, of

philanthropists, and captains of industry. Every year the Assay Board meets at the Mint and its work is inspected. A medal, of various size and shape, has always been stamped commemorative of these sessions. Some of the older dies possess peculiar interest, having been made before the art of die sinking had advanced very far in this country. These dies were generally made in France. Unlike our steel dies of to-day, the bases are made of cast iron, while the face only is made of steel.

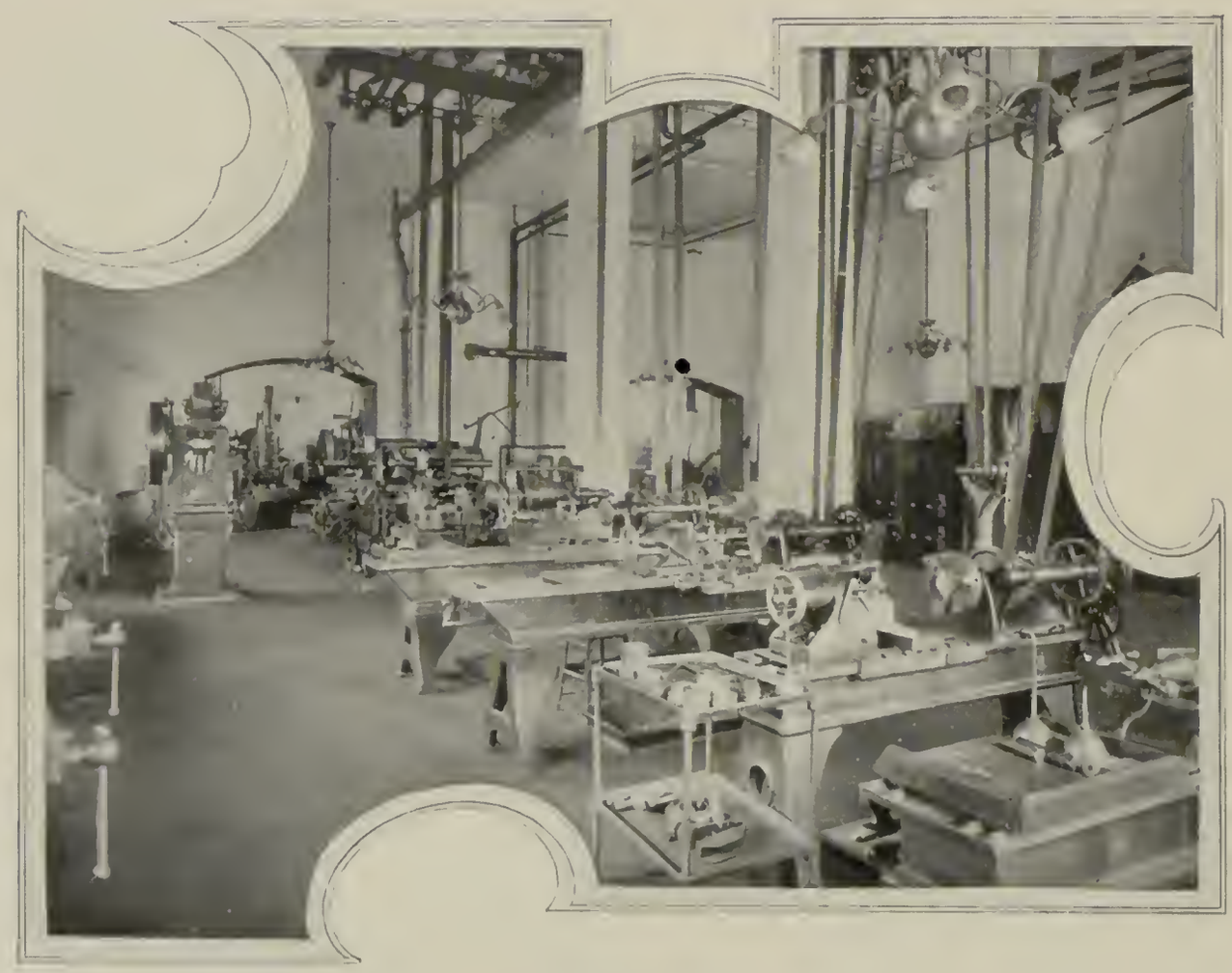
The "business office" of the medal department is in a room on the right hand side of the corridor as you enter the Cabinet. Proof sets of the half dozen silver and minor coins are sold for $2.50, while proof sets of the four gold coins cost $38.50. Any one of the gold coins can be bought at a premium of twenty-five cents, and a proof nickel and cent may be had for eight cents, but the proof sets of silver coins will not be separated. Copies of the gold, silver and bronze medals that have been struck by the government may also be had here at prices ranging from twenty-five cents to nine dollars. Inquiries as to old medals and coins, while directed to the Superintendent of the Mint, are looked after in this office, as are all orders for striking private medals. The law forbids that private medal dies be prepared at the Mint. However, where the dies are furnished by a private individual or society, and the regular business of the Mint will permit, medals will be struck at a charge sufficient to cover the cost of the operation and the metal. As a consequence we see here frequent orders for medals from schools, from athletic societies, or as prizes for exhibits.

WEST INDIAN CAMPAIGN MEDAL
(Obverse and Reverse)

X.

The Sweep Cellar

The Mint is a model of thrifty housewifery. It has been shown how the grated floor of the melting room is taken up each day and all the sweepings melted into a "king" of metal in an old crucible. The care that not a speck of metal be lost, however, does not stop with these visible fragments, but extends to everything that may in any possibility contain bullion that is not



MACHINE SHOP

visible to the eye. To such refuse is given the name "sweeps," which, strange to say, does not include the actual sweepings of the melting room referred to. In the sweeps we find broken crucibles and dipping cups, all ashes from fires, scrapings from flues, burnt gloves, aprons, saw dust and packages in which bullion has been sent to the Mint, and all settlings in catch wells and roof gutters. These are all dried, burnt, crushed and searched, the work being rewarded by annual returns of thousands of dollars from "sweeps."

In the big gloomy tunnel under Seventeenth Street and in back of one of the mammoth vaults, is the furnace where the canvas mits, aprons and bags are burnt up in the search for stray pieces of metal.

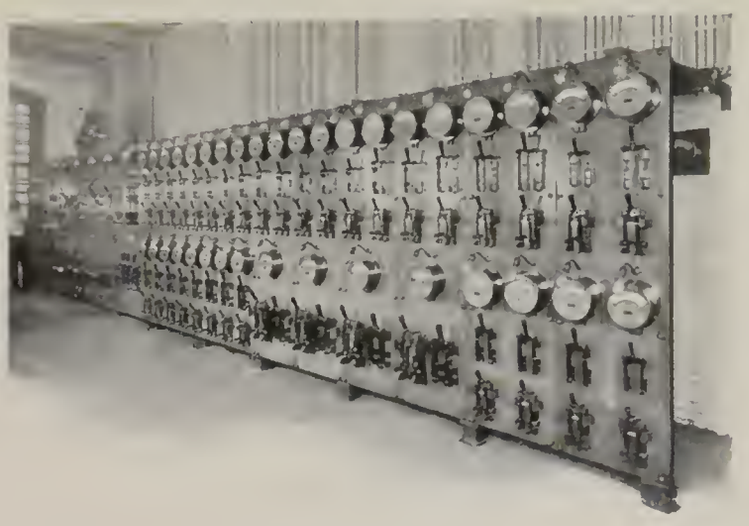
On the opposite side of the building is the "sweep cellar." Here we see a great metal basin, containing broken crucibles, dipping cups and other material that is to be crushed, revolving under two immense stone wheels. On the other side of the room is another improved grinding machine run by an independent motor encased in metal to keep out the dust and dirt. Grimy workmen keep the maw of this monster filled and carry away the ground up portions which are passed out in the front of the machine.

The dust from the grinding mills is sifted. Any pure metal will have been flattened out under the mills while the other brittle substances were ground to powder. These fine pieces of metal are thus recovered, are refined and re-melted.

The powder that passes through the sieve still has value. If it is the refuse of gold workings it is passed through an amalgamator into settling tanks, the mud from which is dried, a sample assayed and the whole sold according to this assay. If silver is being worked the powder is simply sampled, assayed, barreled, and sold to smelters.

The sales of "sweeps" is made on competitive bids, and the income is credited to the Melter and Refiner. The improvements in the general equipment of the new Mint, particularly the introduction of gas as a fuel, has resulted in a great reduction in the amount of "sweeps." The difference was immediately noticeable on the change to the new building. For the last six months in the old building, ending January 1, 1902, the statement of sweeps sold were: Gold, 580.270 oz.; silver, 4267.710 oz. At the end of the next six months, the first in the new building, the sales amounted to: Gold, 102.440 oz.; silver, 2805.07 oz.

For the year ending June 31, 1901, the sale of "sweeps" amounted to about $26,000.00.



SWITCH BOARD

XI

The Vaults

For the storing of the millions of dollars' worth of bullion, coins, blanks and dies, the Mint is provided in different parts of the building with twenty steel lined vaults. The steel used in the vaults would weigh about 3,250,000 pounds.

The largest of these vaults, eight in number, are located in the basement, running under the whole of the Spring Garden Street side of the building, and part of the Sixteenth and Seventeenth Street ends. Two of these, the silver dollar vault and the Cashier's working vault, are classed among the largest of their kind in the world. Each is divided by steel gratings into compartments, which are sealed as soon as filled with the boxes full of coins. This is done in order to avoid a continual reweighing and recounting of their contents. That this is no light task is shown on the change of Superintendents. The money then accounted for by the outgoing official has all to be counted. For this purpose the Director at Washington details a special deputy and force of men who are kept busy in the vaults counting for several months before their work is ended.

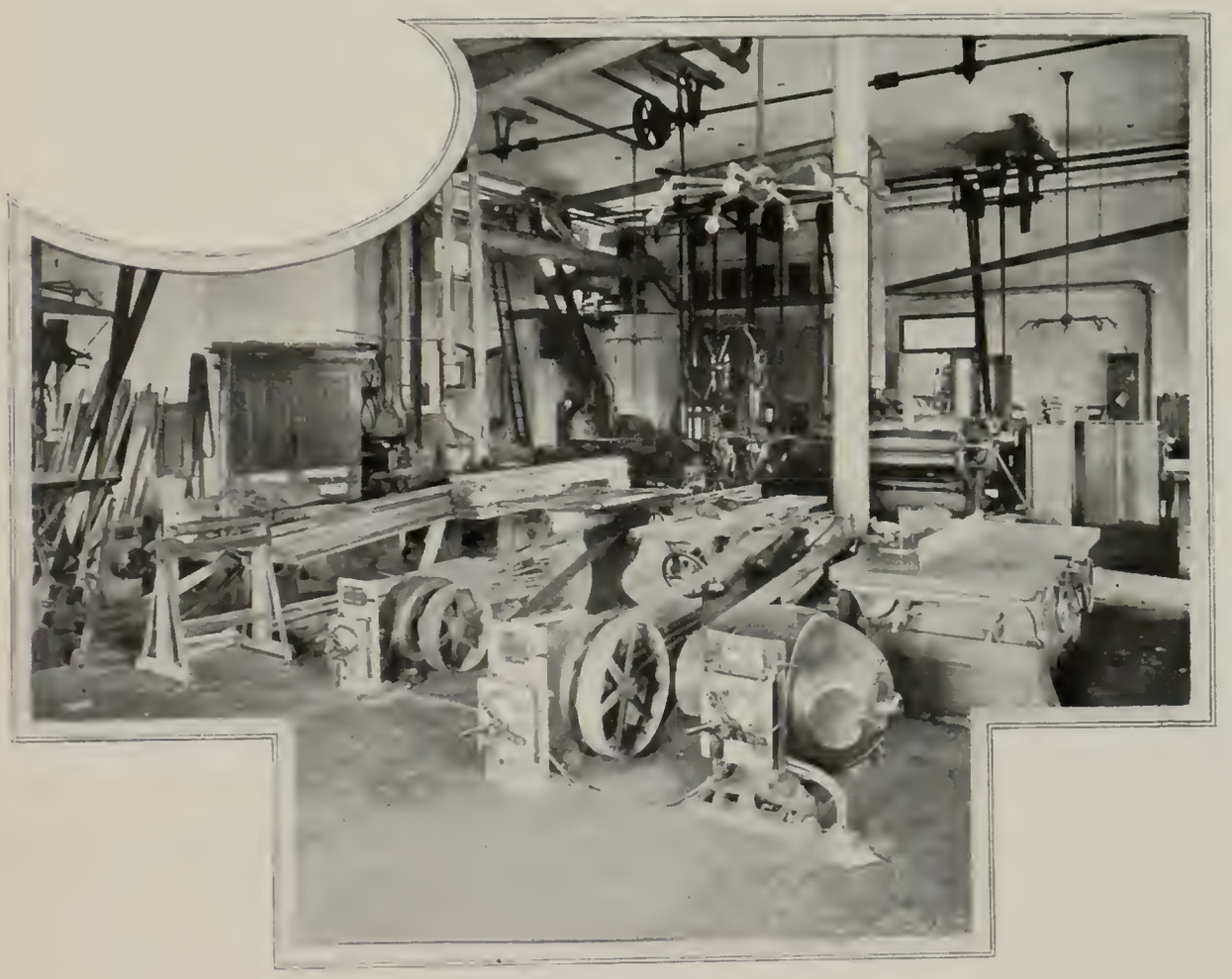
The silver dollar vault, the largest of all, is 100 feet long, fifty-two feet wide and ten and a half feet high. A hundred and twelve million dollars can be stored in it. The next largest vault is the Cashier's working vault, where the coins of various denomination are stored prior to their shipment. It is eighty feet long, fifty-two feet wide and ten and a half feet high. The remaining six vaults, used for storing gold, bullion, bars, etc., run under the front portion of the building. They are 122 feet long, twenty-one feet wide and ten and a half feet high. Three of these open into each other, having but one entrance on the main corridor, the other three have each a separate entrance.

The vaults are constructed on a foundation of concrete; the walls are made of hard bricks laid in cement two and a half feet thick, inside of this being a lining from two to three inches thick of steel that has passed through a special process.

Each entrance is provided with three doors, a heavy outer one six inches thick and two inner ones, arranged in one set, which are slightly lighter than the outer one. The heavy front doors weigh about eight tons. They are mounted on ball bearings, however, and are so well balanced that on the occasion of a visit of High School girls to the institution it was found that one of their number could easily roll one of these massive structures back. There are four combination locks on each door, which can be adjusted to

independent combination. These locks are also provided with a clock arrangement which prevents their being opened excepting at the time to which the clock is set.

One might think that with all this protection few further precautions would be necessary, yet this is but a part of the defense against possible thefts. On the landing of the stairways leading from the entrance hall to the vaults beneath the main stairway is the arsenal, two cases full of rifles and small arms, for the use of the guards. Armed guards patrol the areaways around



THE CARPENTER SHOP

these vaults every night and on Sundays. There are three reliefs. Each guard reports to the central station, where there is an automatic recorder. Over the entrance to the gold vault there is also seen an electric device affording extra protection. This is a light wooden case, the least tampering with which will ring an alarm at police headquarters.

The day of the watchman and his faithful dog has passed on the Mint's record with the death penalty for embezzling coin, and the allowance of "drink money" to the employees.

XII.

The Machine Shops and Power Plant

The minting of money being confined solely to government institutions, new inventions and developments in the machinery are rarely made. Recognizing this fact, the United States government, in 1899, established at the Philadelphia Mint a complete machine shop, capable of turning out practically any piece of minting machinery and of doing all the required repair work. Under the Superintendent of Machinery, experiments were instituted aiming at the improvement of the equipment of the Mint. The results of this progressive step are seen in every department; the most notable changes being the substitution of naphtha gas as fuel in the minting operations, the elimination of the draw bench, and the electrical transmission of power and its application to the various machines, especially the rolling mills. Practically every minting machine in the building is now run by a motor directly connected with the machine. Belting is conspicuous by its absence.

THE MACHINE SHOP.

The machine shop has been divided into three departments, the tool room, erecting shop and machine shop.

The smallest of these is the tool room. Here all the small tools used in the Mint are made and repaired. Each tool, when issued, is replaced by a check, which is surrendered when the tool is returned. The shop is equipped with small grinders, milling machine, lathe, shaper and sensitive drill.

All the heavy work of the machine shops is done in the erecting shop. Every machine set up in the Mint is first assembled and tested here. The shop is provided with a travelling crane capable of carrying four tons. Here we see large lathes, planers, slotter and roll grinding machine, all equipped with independent motors.

The work of repairing and building medium sized machinery is done in the third department, the machine shop.

A great deal of work has been accomplished by these shops since their organization, their value and importance being better recognized every day as the constantly increasing demand on them for machinery witnesses. The nine upsetting machines and one of the cutting presses now being used in the building were designed and built here. All the alterations of machines, fitting of motors to old machines, and other work incident to the installing of the machinery in the new building was done by mechanics from these shops. Rolling mills, cutting presses, multiple shears, upsetting machines, collars for presses, copper colanders, and other machines and minting appliances have been supplied to the Mints at San Francisco and New Orleans.

It has been found that the actual cost of constructing machines in the Mint shops is from 10 per cent. to 25 per cent. less than would be charged by outside contractors. This does not include the interest on installation and depreciation of equipment, but this item is outweighed by the fact that all the machinery used in the shops is needed for the repair work, and further, that there are none of the repairs necessary that are generally incident to outside work where the bidder has cut his profit down to a minimum.

NAPHTHA GAS PLANT

THE NAPHTHA GAS PLANT.

One of the most important innovations of recent years in the minting processes was the substitution of gas for wood and other fuel in the various heating processes. Experiments were made for over a year in the old Mint building, under the direction of Mr. E. P. Reichhelm, of the American Gas Furnace Company, of Elizabeth, N. J., looking towards this substitution. As a result a gas equipment was installed in the new building along the lines developed in this experimental plant.

In a small room in the basement, opening into the driveway on the Sixteenth Street side of the building, are the three gas generators, capable of supplying the equivalent of 22,000 cubic feet of standard, or city gas in an hour. The plant is arranged in three parts, which can be operated singly, in pairs or all together. One part was designed for the supply of the assay department, delivering gas at any desired pressure between a half pound, and a pound and a half per square inch. The remaining two parts supply the other departments, having a capacity of 20,000 cubic feet per hour.

The fundamental principles of the plant are summed up by the Superintendent of Machinery as follows: "Forced atomization of the oil; constant quality and pressure of the gas; utilization of all oil; automatic control as to temperature and pressure, and the manufacture of gas only at the rate it is used in the various departments."

The plant is so arranged with air, gas, and oil valves that when the blower supplying the air is stopped the manufacture of the gas also instantly ceases.

The oil is stored in four large tanks, about eighteen inches below the basement floor, which will hold about 32,000 gallons of naphtha. As the oil is used a supply of water enters the storage, and keeps it filled and under pressure, thus effectually preventing the generation of any gas in the tanks. About 350 gallons of 76° naphtha oil are used in a day.

The economy in installing the gas plant is apparent in many ways. Under the old system but 60 per cent. of the coin blanks were passed as of legal weight and fit for coinage, whereas, since this plant was installed, 90 per cent. are passed. The amount of saving involved will be realized when it is remembered that the condemned blanks represent lost work that has to be gone all over again. In the melting room we have seen that an extra melt per day can be made with a gas furnace, and the decrease in the amount of "sweeps" has been over 50 per cent. The gas furnaces have also been found to be better adapted to the work of the assayer and the refiner. When using wood and coal five extra men were necessary.

It has been estimated that with the gas equipment one-third more work is accomplished for the same expenditure than when the other fuel was used, aside from the better quality of the work which is done.

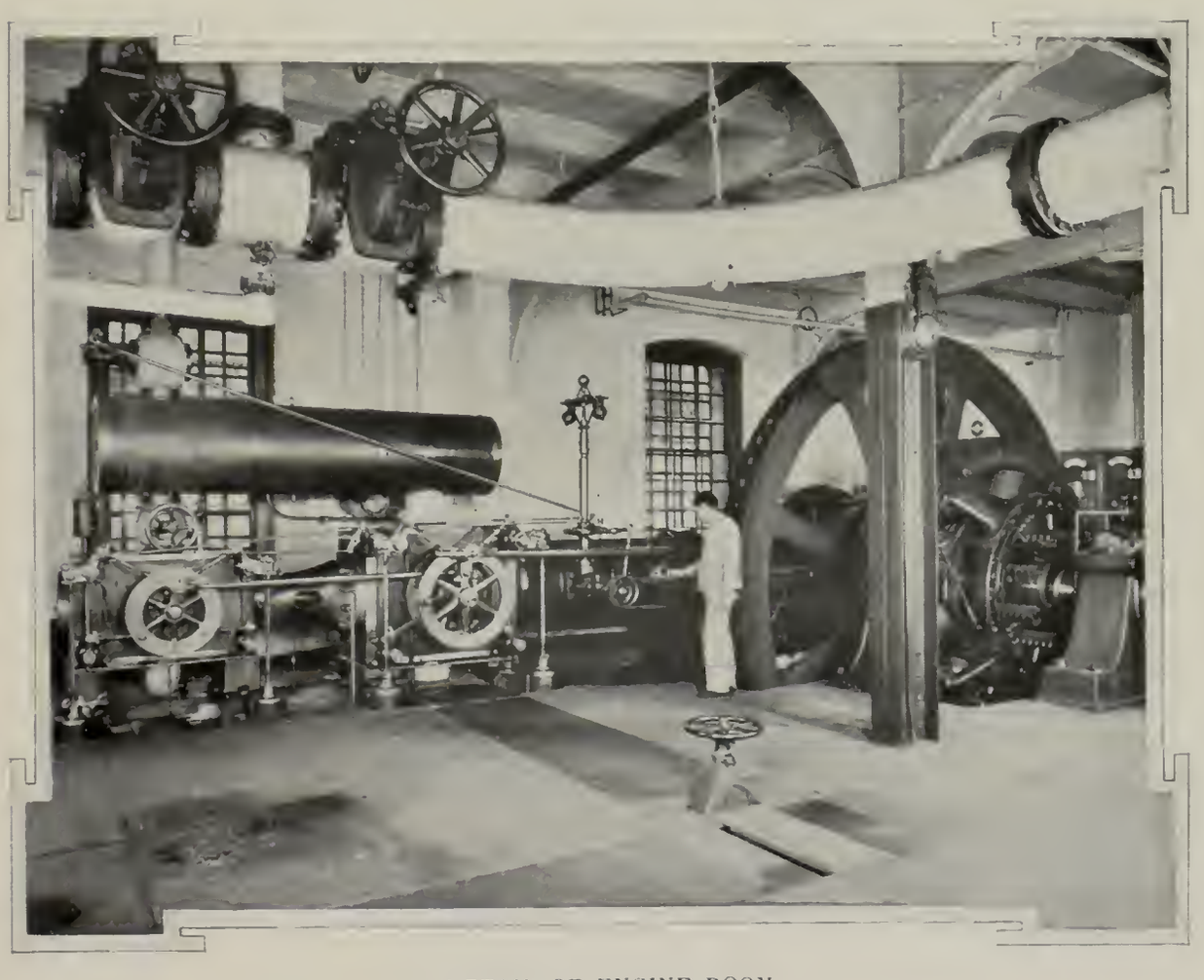
THE POWER PLANT.

The boiler plant of the Mint consists of eight boilers, of the water tube type, arranged in four batteries, and capable of generating 1200 horse power. Between the furnaces and the chimney is a big eight-foot fan making two hundred revolutions per minute. This fan not only acts as a draft for the boiler furnaces, but is used to carry off the heavy nitrous fumes

from the refinery. Exhaust steam is used to heat the water for the building's heating system, and for the hot water used in the coining operations, as well as the feed water for the boilers.

In the engine room are four compound non-condensing Corliss engines, directly connected each with a multipolar generator. The generators are compound wound for direct current at 230 volts. The two largest engines are used for the day load; the smallest for lighting, electrolytic refining, and the night elevators; the fourth is held in reserve in case of accident to the largest, when it can be thrown in with the smallest engine for the day load.

There is a large switchboard in the engine room, made of pink Tennes-



DETAIL OF ENGINE ROOM
(200-K. W. Engine)

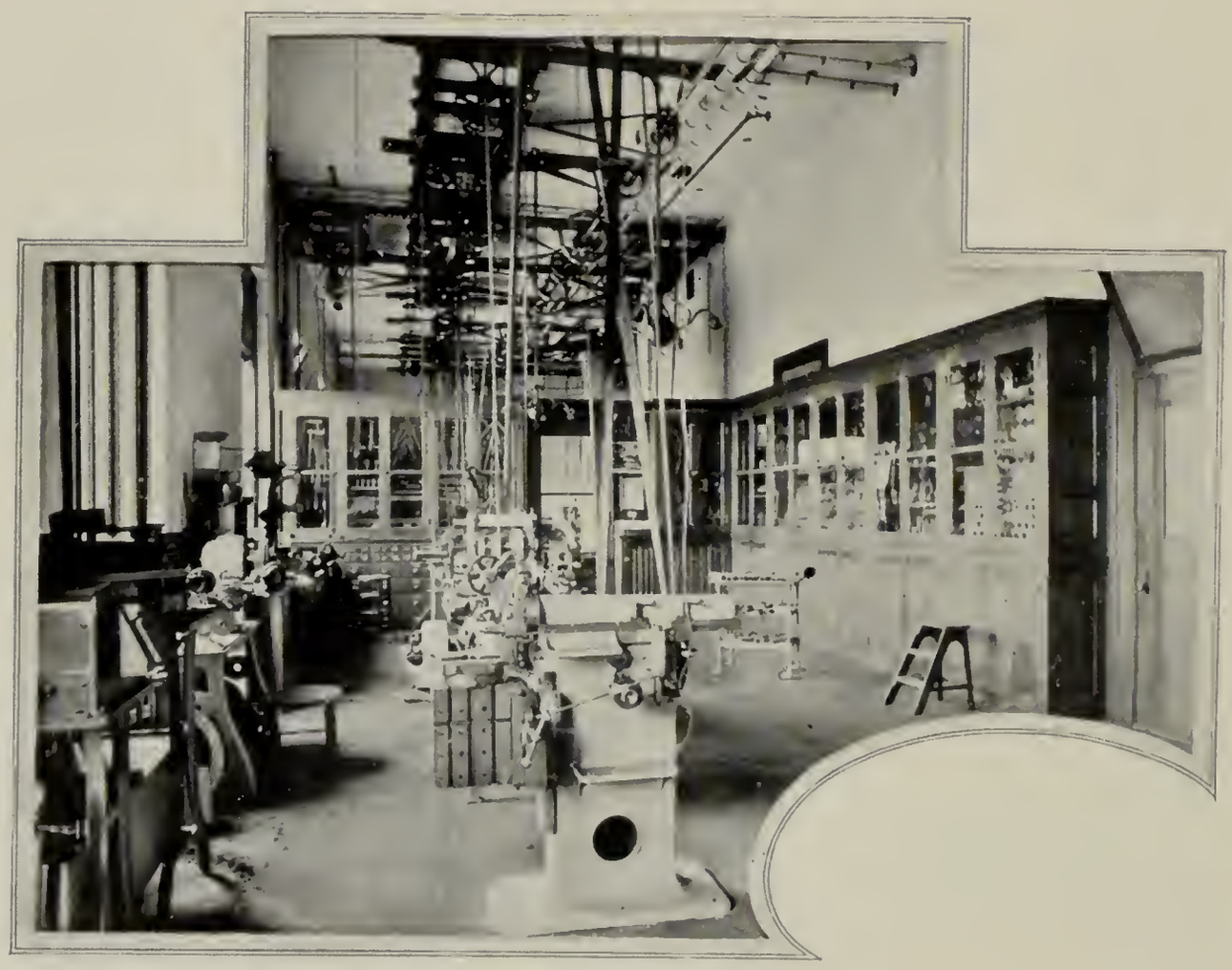
see marble two inches thick, divided into panels for the generators, the lighting, and various motor circuits.

ELECTRIC EQUIPMENT.

With the exception of the light machinery in the carpenter and machine shops and the Engravers' department, all the machines in the building are directly connected with independent motors. For this purpose there are about 140 motors ranging from one-quarter to fifty horse power. There

are about four thousand incandescent lights and twenty arc lights in the building.

The various workrooms and offices are all connected by telephones, fifty-one in all. There are also a like number of time clocks controlled by a master clock. There are thirty-one watchmen's clocks connected to a central clock, where the signals are registered on paper dials. In case of fire an alarm can be rung at any one of the thirty-one boxes in the building. This will cause the number of the box to be struck five times on a gong in the engine room, and another in the office of the Superintendent of Machinery. The number of the box will also be recorded five times on the tape of an ink



THE TOOL ROOM

writing telegraph register. The energy for the telephones, fire alarms, and time clocks is supplied by two series of storage batteries of thirty cells each, one series being used while the other is being charged.

There are seven freight elevators and one passenger elevator in the building, all driven by electric motors. One of the freight elevators is so arranged that by reducing the speed, the lifting power can be greatly increased. Such a powerful elevator is found necessary in moving machinery which varies in weight from two to eight tons.

XIII.

The Cabinet

On completing the tour of the building the visitor is left by the guides in the Cabinet, where he may inspect Uncle Sam's collection of rare coins at his leisure. This octagonal hall is one of the most beautiful architectural features of the building. The walls are wainscoted with a rich reddish brown marble from Vermont, while the high leaded glass dome is supported by eight massive columns of the same stone. Every detail is finished with the greatest elegance. The brass chandelier, hanging from the center of the dome, is a graceful piece of art, and cost $3000.00. Like all the other electric fixtures in the building, it is the work of the Cassidy and Son Manufacturing Company, of New York. The coin cases are made of highly polished mahogany, while the floors are covered with an appropriate design in marble mosaic. A doorway to the west opens into the offices of the Custodian of the collection.

The Cabinet was organized in 1838, and was first recognized by Congress in the following year, when an appropriation was made "for specimens of ores and coins to be reserved at the Mint." Prior to this date, however, the Chief Coiner, Adam Eckfeldt, had been saving patterns of the United States coins passing through his hands, as well as samples of foreign coins which had been left at the Mint as deposits and which he had withheld from the melting pots. From this small beginning has grown the largest collection in the United States. With a small annual appropriation from Congress acquisitions have been made regularly of coins having historic importance.

A mine of historical knowledge, covering the whole world for centuries, is to be found in this collection of eleven thousand coins, and twenty-three thousand medals. The degree of a nation's civilization, its progress in the arts and sciences, may readily be discovered through its coins. In one of the cases will be seen the crude efforts at coinage of the semi-civilized African tribes, while in contrast to them are the delicate coins of the highly cultured Greeks. The hardy Scandinavian of three centuries ago is represented by bronze oblong coins as big as the leaf of a book and weighing from four to eight pounds; the Arabian Caliphs of Egypt, by pieces of glass; the thrifty Chinese, by simple ingots of metal with their weight stamped on them; the African tribes by gold shell pieces and copper ring money; and the Siamese with little stamped "bullets" of gold and silver, or pieces of tin, brass or porcelain.

The historical epochs of a country can be clearly followed in a large and well arranged collection like this. In the beautiful group of French coins, for example, we see first the money of the old kings, then follows the issue made under the constitution extorted from Louis XVI by the revolutionists in 1791, then follows the head of Napoleon, and finally appears the inscription "Republique Francaise." Elsewhere are the coins of the Scottish kings, significantly stopping with the accession of Charles the First. So among the ancient coins, we see the names and faces of each of the successive emperors and rulers of Rome and Greece.

The coins are arranged by countries and placed in chronological order. The oldest coin in the collection, aside from a Chinese piece of doubtful antiquity, is a bronze disc stamped in Greece about 700 B. C.. This is the first of the remarkable series of early Greek coins. Experts have said that this series of coins, particularly the coins of the fourth century B. C., have never been excelled in design or workmanship. It was considered by the Greeks of this time to be a sacrilege for any monarch to place his image on a coin, so that up to the time of Alexander the Great we see on the coins nothing but the heads of mythological gods and heroes. On Alexander's accession to power, however, his face appears as the son of Zeus Ammon, and this precedent was followed by the monarchs who succeeded him, especially the Ptolemaic kings of Alexandria and their Roman successors.

Close to each other, in another case, are two famous New Testament coins—the "widow's mite," and the "penny." The former, called the Lepton or little thing, is the smallest of the ancient bronze coins, being about as big around as the top of a lead pencil and weighing ten grains. It was found in Jerusalem near the site of the Temple and apparently dates to the age just preceding the Christian era.

The smallest known gold coin is one that was issued by the Free City of Nuremburg (A. D. 1522-1532). It was the one-thirty-second of a square ducat, and had a value of about seven and a quarter cents.

Conspicuous among the large coins are the thirty shillings of James the Sixth of Scotland, coined in 1557; the twenty shilling piece coined by his mother Mary in 1556, and also, the fifty real pieces of Philip the Fourth of Spain, dated 1426.

Of interest to the children will be the silver piece of the Caliph Al Raschid, of Arabian Nights fame.

The features of Cleopatra, the last queen of Egypt and the wife of Marc Antony, are to be seen on a bronze and a silver coin of the first century. Here too are seen portraits of both Antony and Cleopatra on the same silver coin.

In the collection there are no less than nineteen rare coins of Scotland, dating from the times of Alexander I to James VI. These coins represent the reigns of David I, William I, David II, Robert II, James III, James IV, James V, Mary and Francis, Mary and Henry Darnley and Charles I. There are also some very rare coins of Great Britain, as that of the Roman usurper Allertus, and those of the British King Cunobelinus. The latter are two small dish shaped gold coins, less than a third of an inch in diameter, showing the figure of a man on one side and on the other that of the sun. These are so rare and costly that they have never been assayed to ascertain the purity of the gold contained in them. A full series of the coins of the various English monarchs can be found, running from King Egbert in 835, to Edward VII of the present day.

The collection of American coins in the Cabinet is, naturally, the most complete in the world. Here is the double eagle of 1849, the only coin of that denomination struck during that year; and the half eagles of 1815 and 1822, both of exceedingly high numismatic value and rarity.

CHANDELIER IN CABINET

In the collection are many rare specimens of the early colonial coins. The designs on most of these are crude. The New England shilling, for instance, was simply a planchet of silver with a small "N. E." stamped on one side, and "XII" on the other. The pine tree and oak tree shillings had rude representations of one of these trees stamped on their obverse side. Many of the early colonial coins had such quaint inscriptions around them as "Value Me as

CABINET

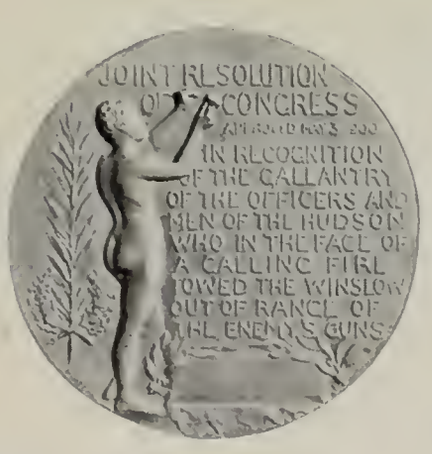
You Please," "I cut my way through," "I am good copper," and "God Preserve Carolina and the Lords Proprietors." A number of the coins like the Bar Cent and the Rosa Americana series, were designed and stamped abroad.

In the early life of the nation some of the smaller denominations of coins were made by private individuals to meet a local demand. These were, as a general rule, of the government weight and fineness, and were received at their face value. They were finally driven out of circulation by the plentiful supply of government coin.

Specimens will be found here of all gold, silver, nickel and bronze pieces issued from the Mint.

The Cabinet also possesses a valuable collection of medals, made in this country and abroad. Many of these are of considerable historical interest, as those connected with our war of the Revolution, the War of 1812, and the Mexican war.

The mineralogical Cabinet contains several hundred specimens of curios relating to the metals and processes used in minting. Here we see the old crude method of determining the fineness by a "touchstone"—a stone on which scratches were made of gold of known fineness with which scratches of the metal under investigation were compared. There are here several specimens of gold working by native Africans. There are also some gold idols found in Central America. A wonderful example of minute assaying is shown in a speck of gold, several hundred of which would be needed to make it worth a cent.



CARDENAS MEDAL
(Obverse and Reverse)

XIV.

Miscellaneous

THE ASSAY BOARD'S ROOM.

Every February an assay commission appointed by the President meets at the Philadelphia Mint and investigates its work for the year. On this occasion the United States standard unit of weight, a bronze pound Troy, is taken from the vaults and the working weights of the Mint compared with it. The standard of weights supplied to the state governments by the Secretary of State is based on the weight on this piece of bronze. The standard

ASSAY BOARD ROOM

test scales, used to test the weights used by the various Mints, are also tested by this commission.

A large room directly over the entrance hall has been especially fitted out in the Mint for the annual sessions of the commission, or any other function held at the Mint building. A long table runs the length of the room. Around the walls are portraits of the different Superintendents of the Mint and other officers of the Mint service.

THE STORE ROOM.

Excepting the bullion, everything delivered at the Mint, from a ton of coal to a paper of pins, is received and credited in the Store Room. This is a small office, the shelves and corners of which are loaded down in a way that would remind one of a country store. If any workman needs a tool, a mit, or any other supply, he presents a requisition from the head of his department to the storekeeper and his order is filled. The accounts of each department are thus kept separate by the Superintendent.

THE SEWING ROOM.

In a small room on the top floor of the north side of the building a force of a half-dozen needle women are kept busy sewing all the time. They supply the bags for packing coin, the workmen's aprons, and the mits used in handling hot metals.

THE SHIPPING ROOM.

The actual shipping of coin from the Mint building is done in a room on the north side of the area in the basement. Here the bags of coin are packed into small heavy kegs, about twenty of which constitute a wagon load. From here they are transferred to the various express companies, who are under contract and bond to do all the transportation for the government. Great precautions are taken in the conveying of the wagon loads of coins. Besides the guard on the wagon itself, trailers or watchers, unknown to the drivers, have it under constant surveillance along the route from the Mint building to the railroad station.

THE KITCHEN.

A large room has been set aside on the third floor of the north side of the building where the employees may eat their lunch. Tables and chairs are provided, and coffee and a light lunch may be had at a reduced rate.

THE GUIDES' ROOM.

To the left on entering the main vestibule is the guides' room. This is the rendezvous for the official conductors when not showing a group of visitors about the building. Partitioned off at one end of this room is the telephone exchange. Here also are the Rochester Time Recorders, by means of which the coming and going of every employee is noted.

Statistics

List of Gold, Silver and Bronze Medals which can be had at the United States Mint at Philadelphia.

FINE GOLD MEDALS.

	Size	Price
TIME INCREASES HIS FAME	16	$9.00
JAMES A. GARFIELD	16	9.00
COMMENCEMENT OF CABINET	12	6.25
WASHINGTON AND JACKSON	10	4.50
LINCOLN AND GARFIELD	10	4.50

FINE SILVER MEDALS.

CABINET MEDAL	37	6.00
PRESIDENCY RELINQUISHED	25	1.50
ALLEGIANCE MEDAL	18	1.00
TIME INCREASES HIS FAME	16	.75
JAMES A. GARFIELD	16	.60
PENNSYLVANIA BI-CENTENNIAL	16	.50
COMMENCEMENT OF CABINET	12	.35
WASHINGTON AND JACKSON	10	.25
WASHINGTON AND LINCOLN	10	.25
WASHINGTON AND GRANT	10	.25
WASHINGTON WREATH	10	.25
LINCOLN AND GRANT	10	.25
LINCOLN BROKEN COLUMN	10	.25
LINCOLN AND GARFIELD	10	.25
VALLEY FORGE CENTENNIAL	25	1.50

ARMY—Bronze.

1.	WASHINGTON before Boston	42	2.00
2.	Major General GATES, for Saratoga	34	1.50
3.	General MORGAN, for Cowpens	35	1.50
4.	JOHN EAGER HOWARD, for Cowpens	28	1.50
5.	Colonel WM. WASHINGTON, for Cowpens	28	1.50
6.	Colonel GEO. CROGAN, for Sandusky	40	1.50
7.	Major General HARRISON, for the Thames	40	1.50
8.	Governor ISAAC SHELBY, for the Thames	40	1.50
9.	Major General SCOTT, for Chippewa and Niagara	40	1.50
10.	Major General GAINES, for Fort Erie	40	1.50
11.	Major General PORTER, for Chippewa, Niagara and Erie	40	1.50
12.	Major General BROWN, for the same	40	1.50
13.	Brigadier General MILLER, for the same	40	1.50
14.	Brigadier General RIPLEY, for the same	40	1.50
15.	Major General MACOMB, Battle of Plattsburg	40	1.50
16.	Major General JACKSON, Battle of New Orleans	40	1.50
17.	Major General TAYLOR, Palo Alto	40	1.00
18.	" " " for Monterey	40	1.50
19	" " " for Buena Vista	56	3.00
20.	Major General SCOTT, for Battles in Mexico	56	3.00
21.	Major General GRANT	64	8.00
22.	Colonel LEE, "Light Horse Harry"	29	1.50
23.	Count De FLEURY for Stony Point	25	1.25
24	ANTHONY WAYNE, for Stony Point	33	1.50
25.	NATHANIEL GREEN, for Eutaw Springs	36	1.50

NAVY.

		Size	Price
30.	JOHN PAUL JONES, for Serapis	36	1.50
31.	Captain THOMAS TRUXTON, for the action with the Frigate D'Insurgente	35	1.50
32.	Captain HULL, for Capture of the Guerriere	40	1.50
33.	Captain JACOB JONES, for Capture of the Frolic	40	1.50
34.	Captain DECATUR, for Capture of the Macedonian	40	1.50
35.	Captain BAINBRIDGE, for Capture of the Java	40	1.50
36.	Captain LAWRENCE, for the Capture of the Peacock	40	1.50
37.	Captain BURROWS, for the Capture of the Boxer	40	1.50
38.	Lieutenant McCALL, for Capture of the Boxer	40	1.50
39.	Captain PERRY, Capture of the British Fleet on Lake Erie	40	1.50
40.	Captain ELLIOTT, for the same	40	1.50
41.	Captain WARRINGTON, for Capture of the Eperveir	40	1.50
42.	Captain BLAKELY, for Capture of the Reindeer	40	1.50
43.	Captain MACDONOUGH, for Capture of the British Fleet on Lake Champlain	40	1.50
44.	Captain HENLEY, for the same	40	1.50
45.	Lieutenant CASSIN, for the same	40	1.50
46.	Captain BIDDLE, for Capture of the Penguin	40	1.50
47.	Captain STEWART, for Capture of the Cyane and Levant	40	1.50
48.	Captain ED. PREBLE, before Tripoli	40	1.50

WASHINGTON MEDALS.

53.	PRESIDENCY RELINQUISHED	25	1.00
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EAGLE	258	90	.50	.19	1.050
HALF EAGLE	129	90	.25	.19	.850
QUARTER EAGLE	64.5	90	.25	.38	
STANDARD DOLLAR	412.5	90	1.50	.36	1.500
HALF DOLLAR	192.9	90	1.50	.77	1.200
QUARTER DOLLAR	96.45	90	1.50	.155	.950
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Denomination	Tons Pressure	Revs. per min.
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EAGLE	110	90
HALF EAGLE	60	90
QUARTER EAGLE	35	90
STANDARD DOLLAR	160	90
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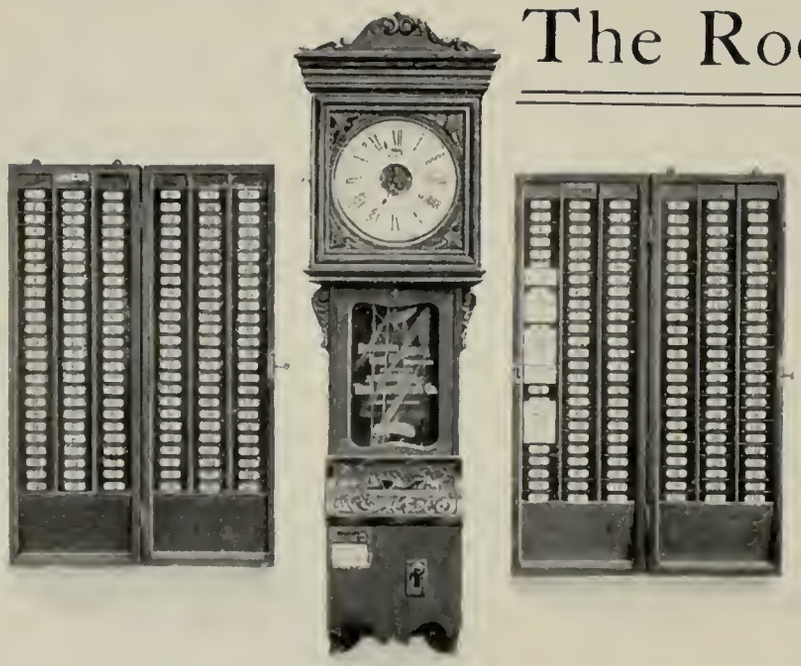

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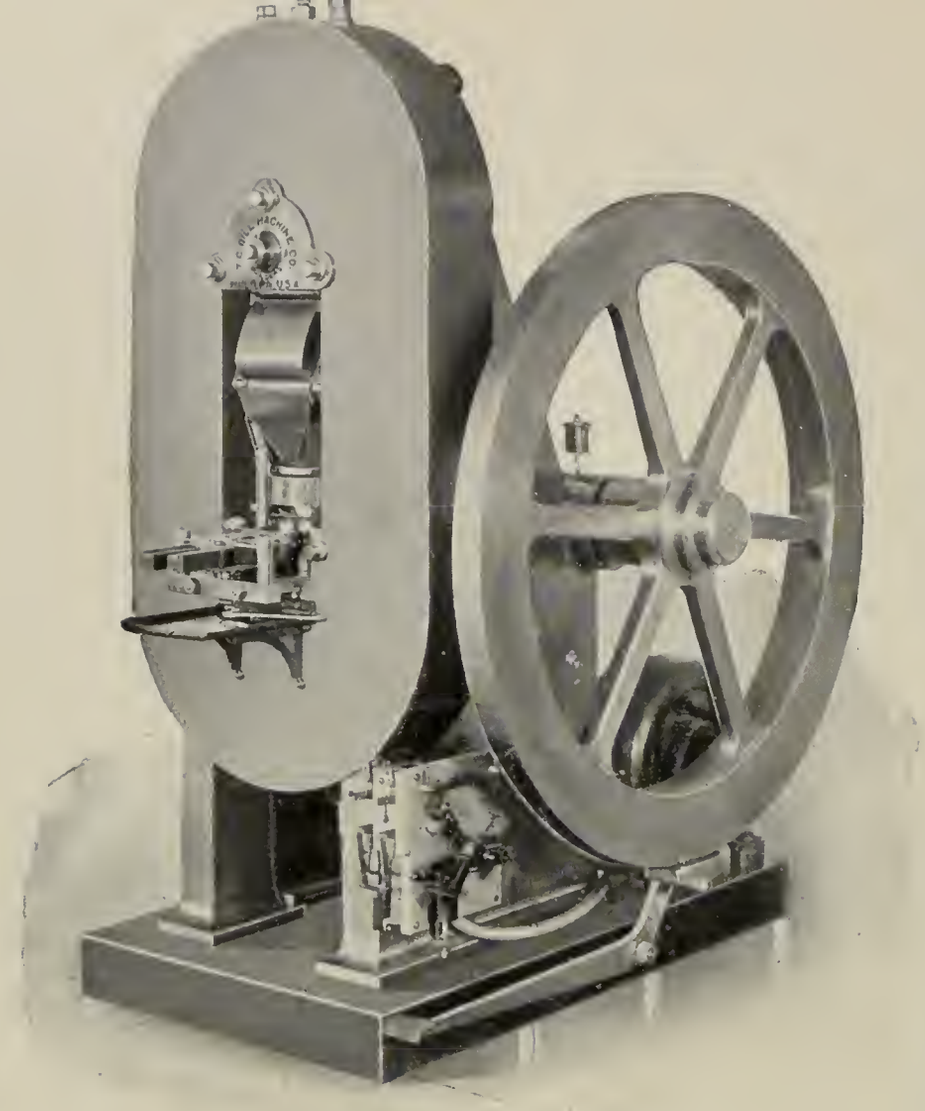

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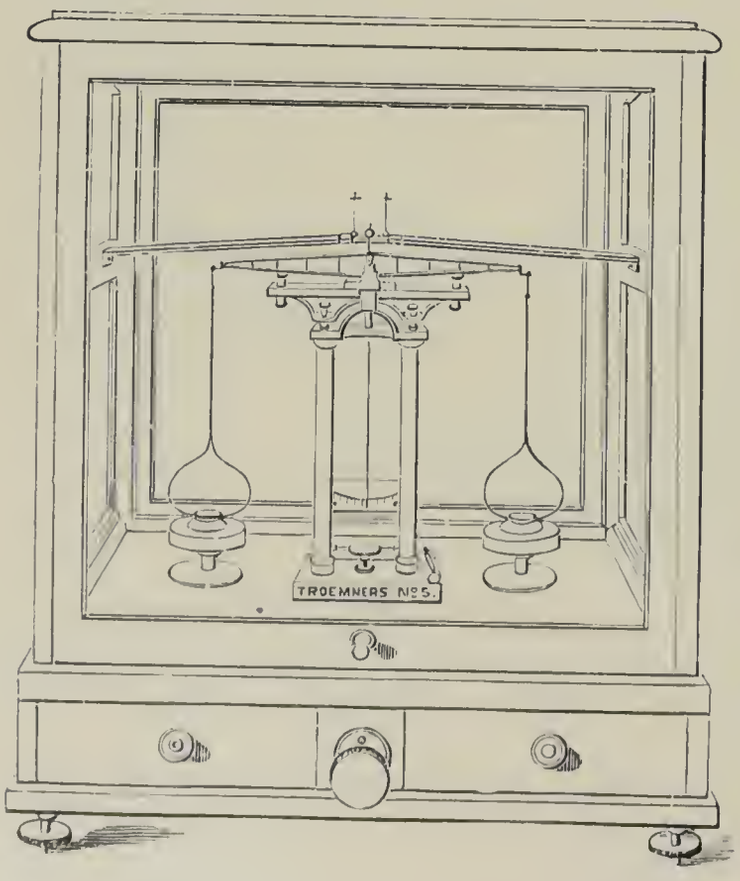

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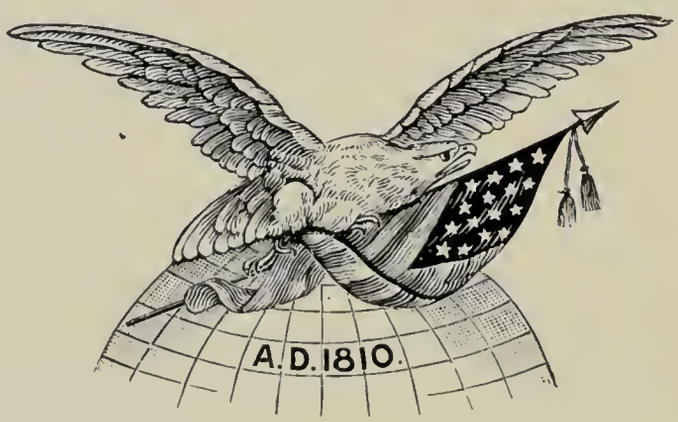

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